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THE MODEL ENGINEER

Vol. 95 No. 2376 THURSDAY NOVEMBER 21 1946 6d.

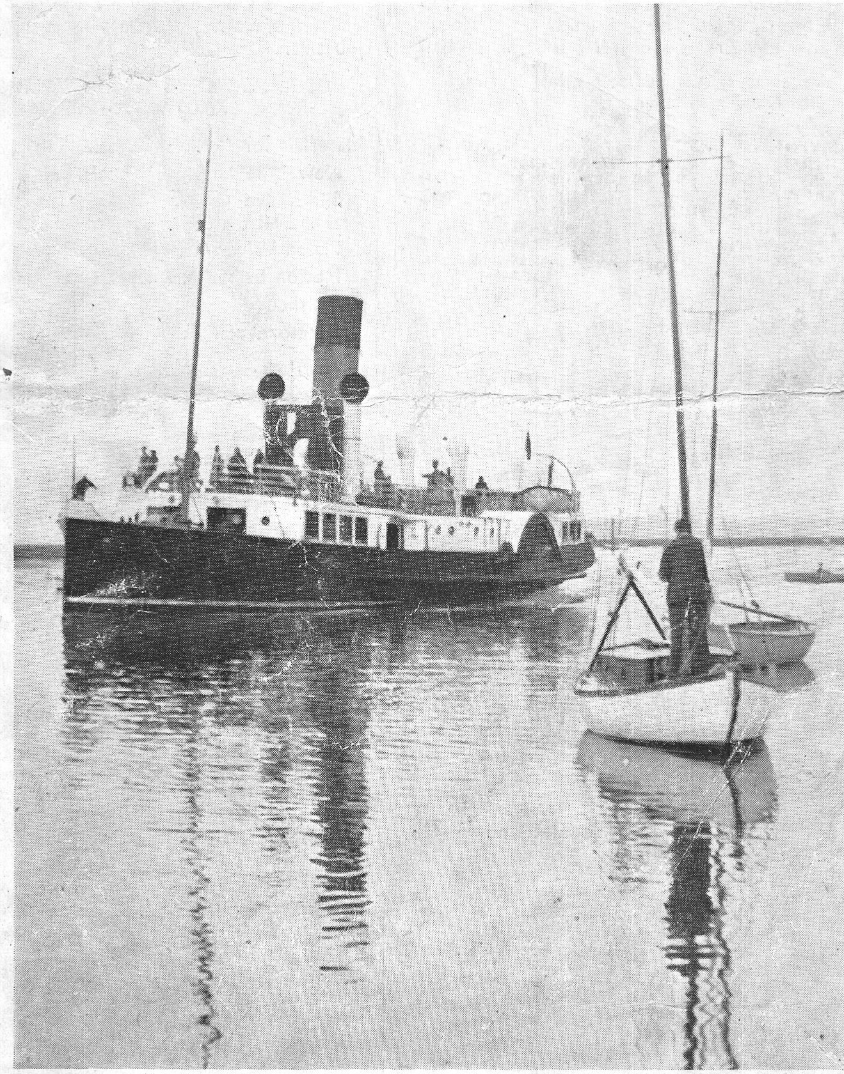

Photo by] [C. B. Maycock

Island Ferry

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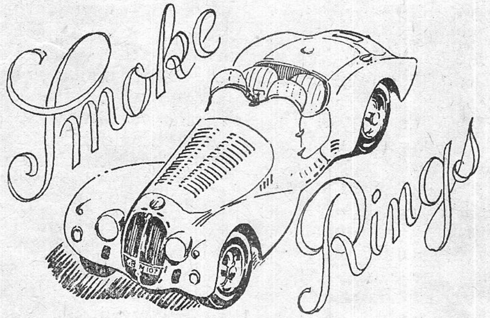
THE MODEL ENGINEER

Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2

VOL. 95. No. 2376 NOVEMBER 21st, 1946



Club Co-operation

AMONG my many exhibition letters was one from "Uncle Jim" Crebbin which pleased me very much. He voiced the general appreciation of the work of club members who, by their exhibits and their willing personal services, contributed so much to the success and enjoyment of the show. He also paid a gallant compliment to the ladies, one of whom assisted in the final cleaning-up of the S.M.E.E. track and packing it for transport. "Uncle Jim" was, of course, himself a star exhibit, and many of my correspondents have recorded their pleasure in being able to shake him by the hand and re-call old time acquaintance. How many miles he drove on the track I do not know; it must have been something prodigious.

To London Ship Modellers

SHIP modellers in the North West London Area, who have, during the war years, missed the opportunity of meeting together will be glad to know that this branch of The Ship Model Society has now resumed its activities. A programme of regular meetings is being arranged, full particulars of which may be obtained from the Hon. Secretary, Mr. A. A. Purves, 65, Eton Avenue, Wembley, Middlesex.

A Veteran's Achievement

I HAVE been very pleased to have a letter from Mr. Alfred H. Avery, telling me that despite advancing years, he managed, during the war, to design and make up no less than 400 of his "Fulmen" electric furnaces in his own workshop, without any outside help. A personal contribution to the war effort, of which he rightly feels rather proud. Mr. Avery came into the model engineering field at a time when small power dynamos and motors had nearly as much sealing wax on their coils as they had wire. By his investigation of the fundamental principles of design, and the application of this knowledge to the popular series of "Fulmen" machines, he conferred a substantial benefit on the army of amateur electricians which existed in pre-wireless days. His well-known book "The A.B.C. of Dynamo Design," and his subsequent very practical volume on armature winding spread workshop electrical knowledge far beyond the ranks of the amateur and gave him a well-earned position among accepted technical authors. Readers of back volumes of THE MODEL ENGINEER will appreciate how much electrical model engineering owes to the efficiency of his brain and pen. It is pleasing to know that the drop in his personal voltage is almost non-existent. Long may he register an effective working pressure.

Another Film

READERS are already aware that, about twelve months ago, there was released the first of a series of films dealing with model engineering; its title was "Model Husbands," and its subject was the design, construction and operation of model boats and ships of all kinds. More recently, "Model Husbands," No. 2, with model aeroplanes as its subject, has been completed and will shortly be available for cinemas, schools and other institutions. "Model Husbands," No. 3, dealing with model railways and locomotives, under the intriguing sub-title of "Once upon a Line," is in active preparation and should be ready early next year; but a more definite announcement will be made later. The purpose of these films is to show something of our hobby in its proper perspective and to help in exploding the idea that models are "toys." In spite of all the past efforts of model engineering societies, individual model engineers and the model engineering journals, there still persists among a large section of the general public and the lay press the idea that our hobby is mere child's-play! Perhaps, this idea may be killed, at long last, when these entertaining films, and others to come, are more generally known.

Percival Marshall

Ship Modellers' Corner

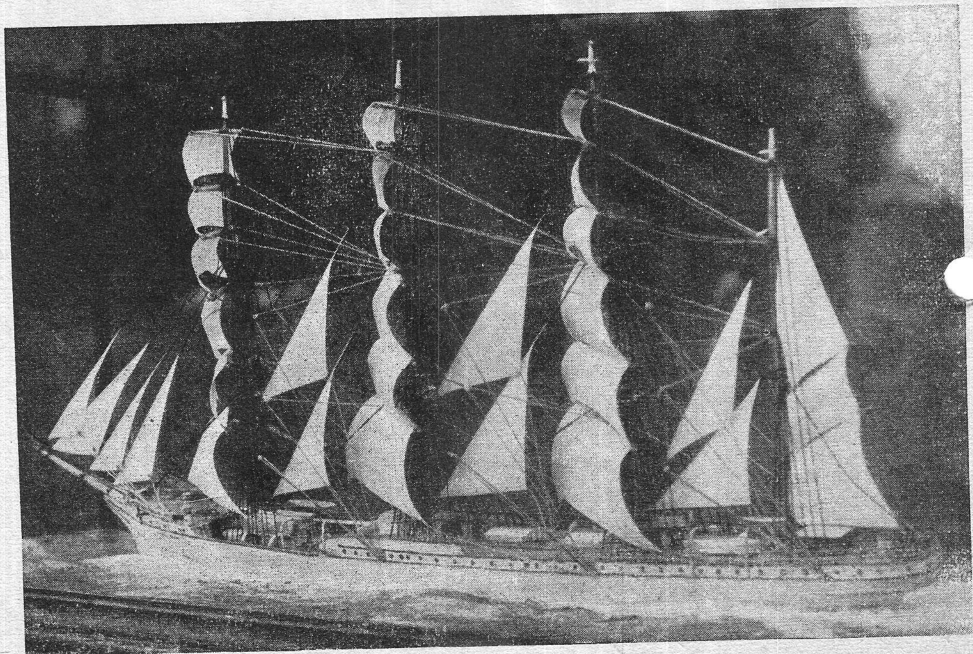
By Edward Bowness

In this final instalment describing the building of the model 4-masted barque "Archibald Russell," the author deals with the sails and sea for the water-line version

SOME modellers of the *Archibald Russell* will undoubtedly prefer to fit it with sails, and show it as a waterline model set in an artificial sea. I have seen models made with the complete hull set on a stand and fitted with sails, but such a model seems all wrong to my mind. Sails suggest speed and action, and to carry them on a model, more especially when it is a small one, the ship should be set in a sea, heeling over to the breeze, and with the sails straining at the sheets.

Then, again, there is the question of the material to be used for the sails. To my mind the finest fabric is too coarse for a model of a smaller scale than $\frac{1}{4}$ in. = 1 ft., and even at that scale fabric must be handled very skilfully if it isn't to look coarse and clumsy. For a model of our scale, viz., $\frac{1}{16}$ in. = 1 ft., I consider fine bond paper, or the best quality typewriting paper, to be the most suitable material. This can be curled after cutting out the shape of the sails, so as to represent very realistically the effect of the wind. My method is to use a celluloid set-square—anything with a smooth straight edge will do equally well—and, laying the sail on a magazine or other soft pad of paper, press the edge of the set-square across the sail as shown in Fig. 70. The upper edge or the head of the square sails is, of course, kept straight, but from one lower corner to the other the sail should be curved forward and upward, giving a somewhat bag-like effect. When the sails are pressed to shape a thin cord should be glued along the edge to represent the bolt rope. If anything, this could lie on the after side of the sail, but it should be as close as possible to the extreme edge. The bolt rope on the fore and aft sails was always on the port side.

In cutting out the square sails, their dimensions should be taken from Fig. 66, see THE MODEL ENGINEER for September 19th, using the scale at the foot of the page. As the sail is secured to the jackstay, which is situated near the top of the yard toward the forward side, the depth of the sail should be measured from this point. A little extra depth should be given to allow for the bellying of the sail. One point to notice in connection with the square sails is that the roach or the curvature at the foot of the lower topsails, the lower t'gans'ls, and the royals is much greater than that on the upper tops'ls and t'gans'ls, the reason being that they have to clear the braces



A waterline model of the "Herzogin Cecilie." Scale 1/32 in. = 1 foot

and fore-stays. The roach of the three courses is cut to be well clear of the deck-houses and boats.

The reef points, which are found only on the courses and the upper topsails, may be drawn in

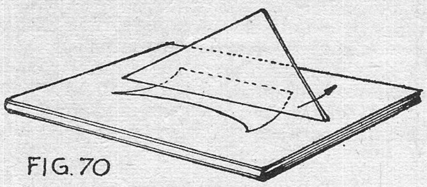


FIG. 70

pencil, or if preferred, short lengths of thread could be passed through the sails and glued to the sail on each side. If not fixed they will assume all sorts of unnatural positions. Before making the holes for the reef points a narrow strip of thin paper should be glued across the sail on each side to represent the reef bands. The reef points are located at the seams between the cloths of the sails and, therefore, should be spaced approximately ⅛ in. apart in the model.

Similarly, the main and mizzen royal staysails (16) were only used in very light breezes. The accompanying photograph of a 1/32-in. scale model of *Herzogin Cecilie*, which I made some years ago, shows a typical 4-mast barque with sails set. The effect of motion with the sails straining at their sheets will be noticed, as will also the heel of the vessel, (don't overdo it!), and the twist on the tiers of square sails. This latter feature is seen also in the photograph of the same model as seen from above, given on page 100 of the issue for August 1st. In this model the sheets of the courses were shown, but not the tacks. These are indicated in the diagram Fig. 66, in the issue for September 19th. The sheets are led aft, the standing end of the tackle being shackled outboard to an eyebolt in the bulwarks just above the line of ports, and the running end taken inboard through a slot in the bulwark and over a sheave fixed to the inside of it. On each side of the ship the sheets should be shown taking the strain of the sail. The tacks are led forward, and on the lee side they will hang slack. On the windward side they share with the sheet the work of keeping

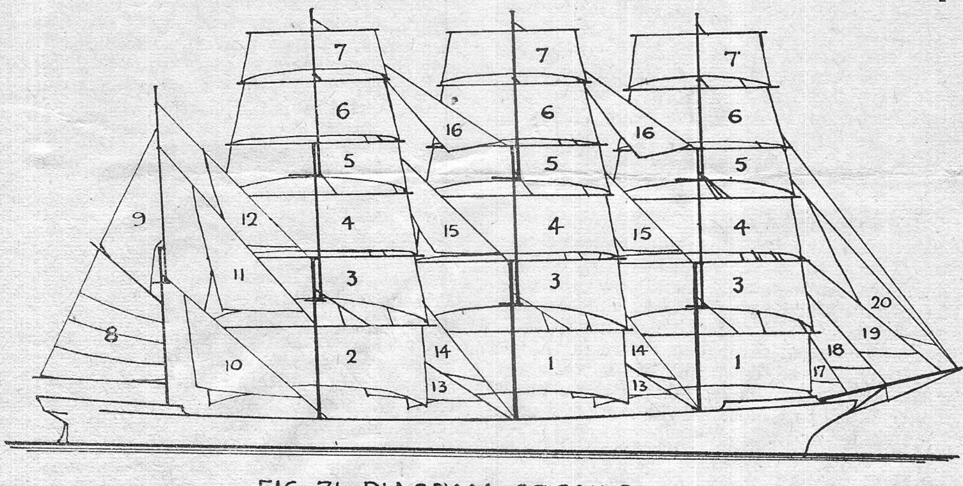


FIG. 71. DIAGRAM OF SAILS

(1) Fore and Main Course.
(2) Mizzen Course or Cro'jack.
(3) Fore, Main and Mizzen Lower Topsail.
(4) ,, ,, ,, ,, Upper ,,
(5) ,, ,, ,, ,, Lower T'gan's'l.
(6) ,, ,, ,, ,, Upper ,,
(7) ,, ,, ,, ,, Royal.
(8) Spanker.
(9) Jigger Topsail.
(10) ,, Staysail.
(11) Jigger Topmast Staysail.
(12) ,, T'gallant ,,
(13) Main and Mizzen Staysail.
(14) ,, ,, ,, Topmast Staysail.
(15) ,, ,, ,, T'gallant ,,
(16) ,, ,, ,, Royal ,,
(17) Fore Topmast Staysail.
(18) Inner Jib.
(19) Outer Jib.
(20) Flying Jib.

The buntlines are, of course, a continuation of those from the mast to the yard, already described. They are led through blocks at the top of the yard and carried down the forward side of the sail to be secured at its lower edge. These should be kept in place by rubbing them with adhesive before fixing them along the sail in their correct positions.

Fig. 71 is a diagram showing the sails, with a key which will assist the uninitiated to identify them. The main and mizzen staysails (13) were not often used, and may be omitted.

the clew of the sail in its forward position, and consequently should be fairly taut. The pendants for the three lower braces on each mast are considerably longer in the *Herzogin Cecilie* than they were in *Archibald Russell*. This will be seen on comparing the Rigging Plan, Fig. 60, (see THE MODEL ENGINEER for June 13th) with the photograph here reproduced.

The jib sheets are secured to cleats on the fo'c'sle head, there being a group of four on each side just forward of the light-houses. Those on the lee side will be taut, whereas those on the

windward side hang loosely over the stay next below, to be belayed to the cleat without any tension. The same remarks apply to the sheets of the various staysails. In the model the sheet on the lee side should be just taut and no more, as excessive tension tends to pull the curvature out of the sail. In this connection I would suggest that when fixing the staysails or jibs to their respective stays they should be glued in such a position that they lie at practically right-angles to the centre-line of the ship; then, when the sheet is attached, the tension pulls the sail back to its normal position leaving a certain amount of bellying to suggest the effect of the wind. Similarly with the square sails, they should be glued along the upper edge and attached to almost the top of the yard, so that the foot lies well forward of the yard below, see Fig. 72. Then when the sheets are attached the sail has the correct curvature. The sheets should be threaded through the lower corners or clews of the sail, just inside the angle of the bolt rope. In connection with the jibs and staysails an additional refinement would be to fix a second thread—thinner than the stay and buff coloured—from the head of the sail to the mast to represent the halliard.

The spanker (8) should be glued to the gaff and to the mast. The foot should be loose, being secured at its after corner, or clew, by means of the outhaul. Three brails, shown in Fig. 71, should be represented by threads glued on each side. Actually they are reeved through blocks on each side of the mast and led down to a spider band at the foot.

The jigger topsail (9) is hooped to the mast between the topmast stay and the lower mast cap. The head is controlled by the halliard, which is led through a block and down the mast. The aftermost angle or the clew, and the tack, are secured by their respective tackles, that for the clew being led through a sheave in the gaff along the gaff and down the mast, while that for the tack, which is on the port side of the spanker, is led to a block on the mast and down to the spider band.

The Base or Sea

The base of a water-line model gives considerable scope for the artistic taste and ability of the modeller. If the model is shown in full sail the waves should not be too pronounced, just long easy rollers. Under such conditions it is unlikely that the waves would have white crests, but for the sake of effect a few white crests could be shown. Referring to the plan view on page 100 of the issue for August 1st, in which the wind is assumed to be on the starboard quarter, the line of the rollers is approximately the same as that of the lower yards. A reasonable bow wave should be shown, but here again, don't overdo it. The wake will, of course, be white and frothy, with the waves spreading on either side. On the windward side some broken water may be shown with a wave or two breaking up the side of the ship. Whenever the water-line ship modeller has the opportunity of a sea trip, even if it is only the crossing to the Continent, he will have endless opportunities of studying the wave formation about the ship if he takes the trouble to walk around the ship and watch the various effects fore and aft, and to note the difference between the waves on either side.

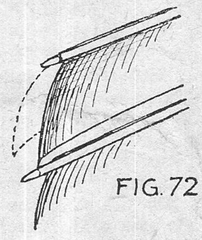


FIG. 72

The base should be made of a piece of wood approximately 24 in. long by 8 in. wide by $\frac{5}{8}$ in. thick. Yellow pine, if obtainable, is probably the best wood to use, but, failing that, any soft cheesy wood with a close grain is suitable; a hard wood is not necessary. After squaring the wood, cut a recess in the centre to receive the hull, which, as already explained, has been cut off flat about $\frac{1}{4}$ in. below the water-line. The bottom of the recess should be inclined athwartship, as shown in the section, Fig. 73, to give the required heel to the ship. For carving the sea use a gouge, not too flat, and work from crest to crest, rather than along the troughs. The small hollows so formed suggest the irregular surface of the water very effectively.

Next, place the ship in the recess securing it in position by means of a screw fore and aft, screwing them in from below. Then with plastic wood fill in any space which may be left between the recess and the sides of the hull, and form the bow wave and the waves along the sides, working the plastic wood between finger and thumb. When set it can be carved to blend with the normal wave formation. Plastic wood sets with a certain roughness, and advantage should be taken of this to suggest the broken water alongside the ship and on the crests of the waves. A little should be worked on to the top of the ridges where it is desired to show broken water.

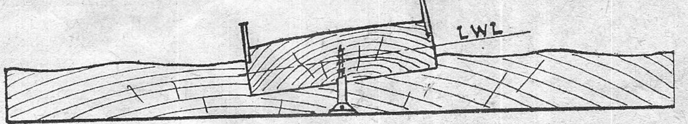


FIG. 73

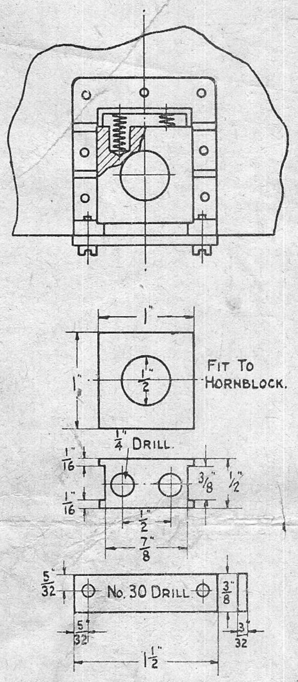
In painting the sea one usually wishes to suggest a blue sky and sunny conditions. This results in a sea with deep blue in the troughs, shading towards green at the top of the rollers,

(*Continued on page* 496)

"L.B.S.C." expounds the 0-4-0 side tank
"JULIET"

BEFORE proceeding with more details of the little passenger-hauling engine that will run around the edge of a dinner-plate, here is an item of news. Some of our readers have a hankering after a simple locomotive on $7\frac{1}{4}$-in. gauge, and are not satisfied with any existing design because it doesn't conform to "Live Steam" specification and is not "genuine Curly," so they want to know "what I'm going to do about it." Well, let these good folk get some $\frac{3}{16}$-in. steel plate and angle, and exercise their muscles, hacksaws, and files in carving out a pair of frames and a couple of buffer-beams to double the dimensions given for "Juliet." Don't cut any slots in the beams for fitting frames, as I haven't yet settled what will be a suitable width for this size, at time of writing. Then, if all goes well, and our friend with the blue pencil raises no objection, I'll tell you how to build up the frames into a $7\frac{1}{4}$-in. gauge engine, "between whiles." She will have either link-motion or outside valve gear as desired, brakes, and all the usual impedimenta, and we'll call her "Julia," as she is a relation to the little one. This looks like fulfilling another long-felt want! Anybody wanting a six-coupled engine, can double the frame dimensions of "P. V. Baker," and use the same type and size of cylinders and motion that I shall describe for "Julia."

Carrying on with the $3\frac{1}{2}$-in. gauger, the next job will be the axleboxes, and these are shown in the accompanying illustrations. They are machined up exactly as described for the "Lassie" and other engines given in these notes; but they differ in each having two simple overhead coiled springs resting in drilled pockets, and bearing against the top of the hornblock. The springs should be made from 20- or 21-gauge tinned steel wire wound around a piece of $\frac{1}{8}$-in. rod held in the three-jaw. Touch the ends on a fast-running emery-wheel after cutting to full length. The springs should just start to compress when the horn-stays are put on. Beginners should note that the axleboxes must not have any fore-and-aft movement; they should slide easily between the horncheeks, without slackness. They should, however, be allowed a little side movement, so that the axles can tilt when the engine runs over a bad bit of road, or through wide rail joints or crossing frogs. The hornstays are merely $1\frac{1}{2}$-in. lengths of $\frac{3}{8}$-in. by 3/32-in. flat steel, with two No. 30 holes as shown, and are attached to the hornblock lugs by $\frac{1}{8}$-in. or 5-B.A. screws. Assemble the whole lot as shown, and jam a piece of $\frac{1}{8}$-in. square rod, or piece of metal, between each hornstay and axlebox, so as to keep the boxes in running position while the motion work is erected. The running position is with the box midway in the hornblock, with a $\frac{1}{8}$-in. space at top and bottom, the centres of axles being $\frac{5}{8}$ in. from the bottom line of frames.



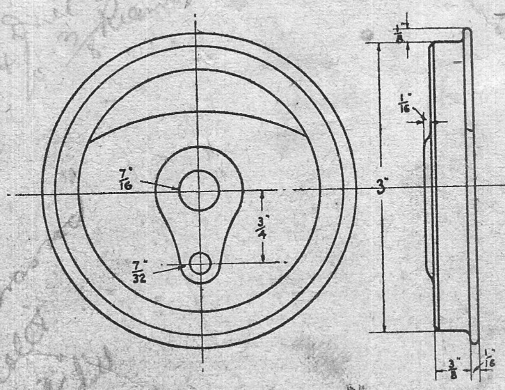
Hornblock and axlebox details

The four-coupled wheels are 3 in. on tread, with $\frac{1}{16}$-in. flanges $\frac{1}{8}$ in. deep. The back of the wheel is flush, and the bosses carrying crankpins project $\frac{1}{16}$ in. from the wheel rims. They are machined up exactly the same as described for the "Lassie" and other engines, the treads being cylindrical, or parallel, except for a slight chamfer at the edge. Beginners should recollect that the radius at the root of flange should not be too small, otherwise the full depth of flange will bear against the railhead all the time, with consequent loss of power, increased friction, wear of rails, and brake effect; an important consideration when the engine is required to work continually over sharp curves. The less flange friction, the better, both for engine and rails.

The leading crankpins can be made from $\frac{1}{4}$-in. round silver-steel, and the driving crankpins from $\frac{5}{16}$-in. ditto, the machining and fitting being carried out as for "Lassie." Note that the driving-pins have screwed ends, 4-B.A. or 5/32-in. by 40, and not plain spigots, as the engine has inside valve-gear. The portion which enters the hole in the wheel-boss must be turned to a tight press-fit, but be careful not to overdo it and split the wheel-bosses. The holes for the pins are drilled in the wheel-bosses by jig, as per "Lassie" instructions.

The axles can be turned from $\frac{1}{2}$-in. round steel; ground mild-steel, or ordinary silver-steel is the best material, but ordinary drawn rod may be used if nothing else is available. Failing ground or drawn rod, use black mild-steel of nearest larger diameter available, and turn the whole axle between centres. Centre a piece about $4\frac{3}{4}$ in. long; turn it down to $\frac{1}{2}$ in. diameter for full length, then reduce the ends to a drive-fit in

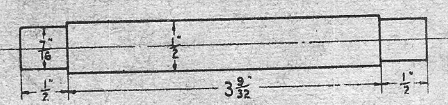
the holes in wheel-bosses, as per "Lassie" notes, leaving the centre portion 3 9/32 in. between, shoulders. Do the end nearest the tailstock first, then reverse between centres, putting the carrier on the other end. Finally, chuck in three-jaw and shorten the wheel seats to ½ in. in length, with a knife tool. Round rod of correct size may



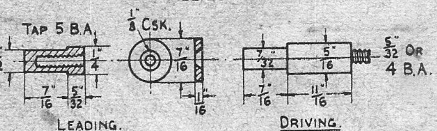
Coupled wheels

be chucked truly in three-jaw, and the wheel seats turned to diameter and length at the one setting.

The leading wheels can be put on the axle and pressed home right away. Press one on in the vice, poke it through the axleboxes, and put the other on by hand as far as it will go, setting the crankpins at right-angles "by eye." Then remove axleboxes with wheels and axles complete and quarter them as described for "Petrolea." To repeat briefly for beginners, stand the assembly on something level, such as the lathe bed, and set the left wheel with the crankpin right down, so that the edge of a try-square blade passes exactly over centre of both



Axle



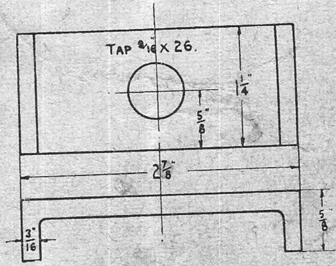
Crankpins

axle and crankpins. Put a block or something under the wheel each side, to prevent rolling; and see that the stock of the square lies fair and full length on the bed. Set the point of your scribing-block needle to the centre of the axle; then adjust the other crankpin so that the needle is dead in the centre of it when the crankpin is a quarter turn ahead of the one right down. The wheel can then be pressed home in the vice, and the assembly restored to its place in the frame.

Press one driving wheel on the axle, and put same in place, but only put the othe on by hand, for the time being. Before it is pressed home, the eccentrics and stop collars have to be made and fitted.

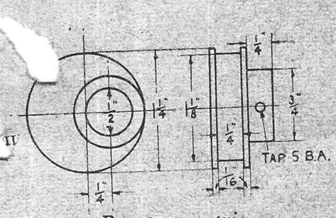
Boiler-feed Pump

The eccentric for the pump is the same as described for the "Lassie," a drawing of it being reproduced here, and it is turned from a piece of 1¼-in. round mild-steel (piece of shafting does fine) to the dimensions given. The sizes for the pump-stay are also shown; this may be made either from a casting, or a piece of 1¼-in. by 3/16-in. flat brass bar 2⅞ in. long, with a piece of angle



Pump stay

brass riveted on each end, for attachment to frames. The pump itself is exactly as described for the "Lassie"—the smaller pump, ⅜ in. bore and ½ in. stroke; and if you refer back to the drawings and instructions for that, which appeared not so long ago (page 189, February 21st issue) it will save needless repetition. The only difference is that the eccentric-rod is 1/16 in. longer between centres of strap and eye. The complete pump is erected between the frames, barrel pointing towards rear of engine, and back of valve-box exactly ⅛ in. away from the leading axle. The pump barrel should be set horizontally, so that its centre-line passes through the centre of the driving-axle, and the bottom of the stay should be level with the bottom of the frames. Well, I guess that will be enough to keep "Juliet" builders busy for a couple of weeks or so; next spasm will be coupling-rods and cylinders.



Pump eccentric

A Co-operative Job

The locomotive shown in the accompanying reproduced photograph shows what can be done when a few club members show the real club spirit in giving practical help and advice to a fellow-member in need of same; and it gives your humble servant much pleasure indeed to be able to put it on record. A member of the Grimsby and Cleethorpes S.M.E., Mr. A. Grose, was an ardent member of the power-boat section of the club, but became infected with the loco-

motive microbe; and knowing very little about locomotives, thought it would be a good plan to acquire an incomplete engine, and finish it off by aid of some of the locomotive fraternity among the members. This idea seemed O.K. and a partly-finished engine was purchased; but then the fun began! The engine proved an awful washout; the chassis was very poor, the valve-gear being Marshall's patent radial gear, and far too flimsy to stand up to hard work such as passenger hauling. The boiler was a rivet-and-solder job, with much more solder than rivets, and there were various other imperfections, so that our worthy friend began to feel down in the dumps, and to despair of carrying out his desire. However, he took the pieces along to a club meeting, and the locomotive members held a post-mortem on it, the verdict being that the job could be resurrected by co-operative action. One member took the chassis in hand, and fitted a complete new Joy valve-gear in place of the original Marshall; another turned a new crank-axle out of the solid; a third took the boiler in hand, dissected it, salvaged the barrel, put a new firebox wrapper on it, fitted a new inside firebox and brazed up the whole bag of tricks. Meantime our worthy friend himself was not idle. Although he only has a weeny lathe, similar to the one first acquired by young Curly of the 'nineties, he took the smokebox in hand, and turned up a new ring and door, which was "passed for service" by the other members of the locomotive co-operative society. He then turned his attention to the details, making new buffers, dummy Westinghouse donkey, brake pipes, screw couplings and other oddments.

The engine was eventually completed, and the members taking part in the resurrection were so enthusiastic to try out the result of their combined efforts, that the trial run was made in a snowstorm, the rails having to be cleared in front of the engine. She responded nobly, performing truly both to the traditions of the old "Brighton," and the gospel of "Live Steam" as preached in these notes and practised by your humble servant. The engine is only $2\frac{1}{2}$-in. gauge, and measures 23 in. over buffers; but the boiler, which is practically "scale" size, with a narrow firebox, steams excellently, and the locomotive hauls a living load in the manner usually observed among good and efficient railway engines. Our friend was so pleased with her performance, and so grateful to the club members for their assistance, that he set to work with a will to finish her off with the requisite blobs and gadgets and a coat of paint; the result you see in the picture. He apologises for the Stanier chimney and dome, but says they will be replaced by correct "Brighton" type adornments in the near future; and concludes his letter with the fervent wish that his experiences may give some encouragement to others who may be in similar circumstances. You bet they will; and followers of these notes won't need any invitation to join old Curly in offering hearty congratulations to Mr. Grose on the success attending his endeavours, and also to the willing and able helpers who came to his assistance in time of need. A fine example indeed, of the spirit that *should* animate every club in existence; and a lesson that I sincerely hope will be taken to heart by those who delight in finding fault with the work of others. Yes—there are black sheep in every flock!

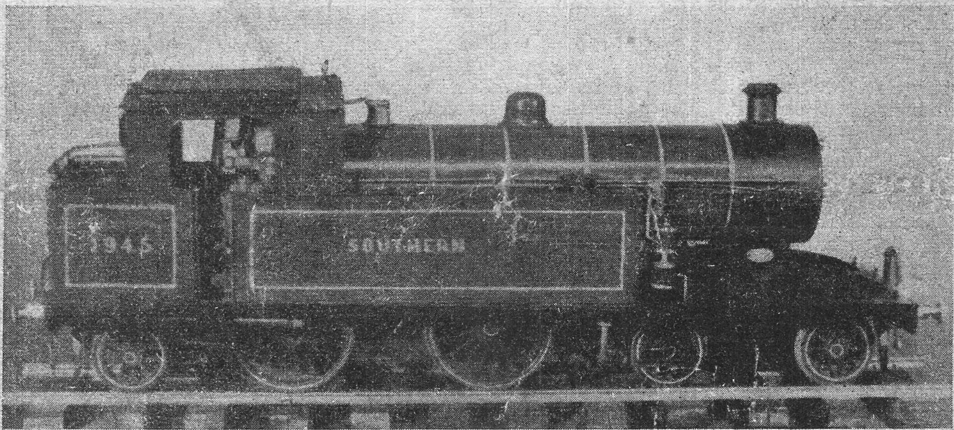


Photo by] *Many hands make light work!* [*T. J. Warren*

Valve-gear Tip for the "Lassie"

A couple of letters from correspondents asking what is the correct amount of clearance to allow between the die-blocks, and the ends of the slots in the expansion-links, of a Walschaerts motion in full gear, reminds me of a small omission made when describing the Walschaerts gear for the "Lassie." The omission was obvious, but in case any beginners get fogged, I'll call attention to it right here. I forgot to state, when describing the assembly of the expansion links, that the little distance-pieces, or spacers, at top and bottom, should be bevelled off at each end; so that when the links swing over to their full extent, and the motion is in full gear, the radius-rods will not catch against the corners and prevent full movement of the die-block. I couldn't help a chuckle to myself when I thought of it, because

here is a *disadvantage* of doing the actual job myself! When assembling a link of the pattern specified for the "Lassie," I just pick up a file and proceed to take the corners off the spacers without thinking a blessed word about it, taking the job as a matter of course; and as I do every job "in my mind's eye" as I write the description of it, I guess that little item was passed over with the same—well, nonchalance, shall we call it?—as it would have been if I had actually been building up the links instead of giving instructions on how to make them. Anyway, there's no harm done; and anybody who didn't bevel off the corners, can do the whole lot in two or three minutes, by judicious use of a thin flat file, without dismantling anything. Sincere apologies if anyone happened to led astray!

Reverting to the query, about 1/32-in. clearance is enough on a $3\frac{1}{2}$-in. gauge locomotive, which will allow for the small amount of die-slip which takes place when a radius-rod is guided by a die-block, as on the "Lassie," or with suspension by a long hanger behind the link, as on the Maunsell 2-6-0's of the Southern Railway. In cases where the radius-rod is suspended from a short hanger ahead of the link, there is more die-slip, owing to the short radius in which the end of the hanger swings; but as long as the die-block doesn't actually hit the end of the slot in its lowest position, all will be well. The point was also raised about making the slot slightly wider for about $\frac{1}{16}$ in. each side, top and bottom, to prevent steps being formed by the die-block at each extremity of its travel. There is not the least objection to this; full-sized engines have a considerable amount of clearance at each end of the link, the die-block slightly over-running the gap in full gear. On a little engine with hardened links and die-blocks, there is little fear of wearing steps in the slots; and anyway, with the valve-gears specified in these notes, the usual place for the die-block, when running, is very nearly in the middle of the link, so that the movement is too small to wear a step during the lifetime of the engine!

Ratio of Ports to Passages

A reader of these notes ordered a pair of finished cylinders from an advertiser, to be made to my published specifications; and refused to accept delivery because the advertiser milled out the passage-ways to the same size as the ports. The advertiser said he did it because there was no sense in having a big port if the connecting passage-way was smaller in cross-section. Several beginners who are aware of this transaction, ask if the advertiser was right or wrong, or the customer justified in refusing the cylinders.

This is a case where the customer was right. The advertiser—and many other people—overlooked the fact that *the passage-ways are always full open*, but the ports are not. The passage-ways need to be just large enough to pass the requisite amount of steam in the time available, according to the speed of the engine, and no more. Passage-ways have to be filled and emptied at every stroke, at both ends of the cylinder; *and the steam is blown to waste*, therefore a cylinder with huge passage-ways takes twice as much steam, in many cases, as one with passages drilled to my specifications. This is one reason why one or two advertisers—Mr. Simmonds, for instance—cast ports in the cylinders, but leave passage-ways to be drilled.

The reason for the big ports and quick valve-travel, is to enable sufficient steam to pass the edge of the valve, to build up full pressure on the piston head as the crank passes the dead centre; and if the advertiser and other folk check the amount of initial port opening against the full passage area, they will find the latter is by far the larger. This condition also applies when the engine is running fast, and well notched up. When the engine is running slowly, and the valves are opening the ports to the extent allowed in full gear, the port opening is more than the passage area; but this doesn't matter a bean, because the speed of the engine gives the steam plenty of time to get into the cylinder and perform its allotted task, with the absolute minimum of wastage. Time is the deciding factor in the last-mentioned instance.

Ship Modellers' Corner

(*Continued from page* 492)

and culminating in white for the broken water of the crests and along the sides of the vessel. On the other hand, one may prefer to show the model under stormy conditions. In this case much less sail should be set, in the extreme case cutting down to the six topsails. One of the most effective water-line models I have seen is that of the *Herzogin Cecilie* in the Deutches Museum, Munich, showing her under just these conditions, with the figures of over sixty officers, cadets and men on the yards and on deck shortening sail. The model was about six feet long and was a magnificent piece of work. The sea was grey and threatening, as was appropriate. Across the passage there was a similar model of the five-masted ship *Preussen* with all sail set and on a pleasant sea of blue and green. Both models were very impressive in their different ways. The modeller is strongly advised to experiment, both with the carving and the painting, on a piece of scrap wood before commencing work on the wood which is to form the actual base.

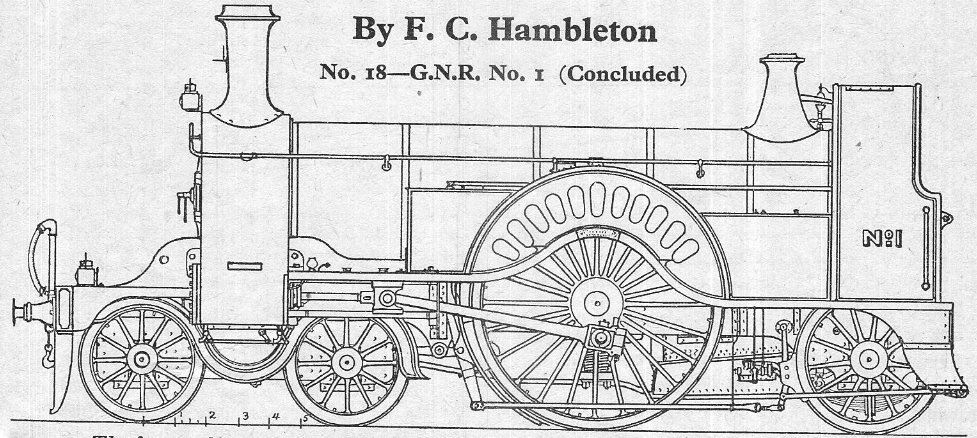
Many water-line modellers, especially sailors, prefer to make their seas in putty, but my objection to it is the smooth, oily effect which seems to result. A wooden sea such as here described has a freshness and naturalness which I have never seen produced by any other means.

That, I think, completes the instructions for making the model of the *Archibald Russell*, both with and without sails. I have tried to describe fully all the points which are likely to arise, but if there is anything not quite clear to any of our readers, a letter to the writer, c/o Editor, will always have attention.

LOCOMOTIVES WORTH MODELLING

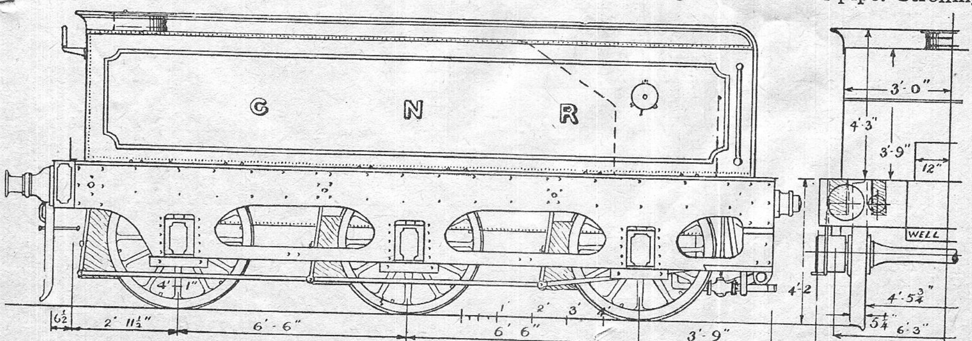
By F. C. Hambleton

No. 18—G.N.R. No. 1 (Concluded)

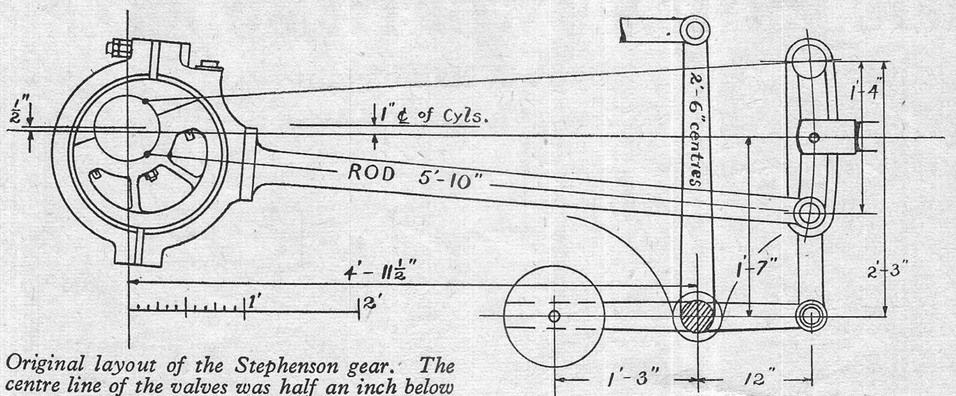


The famous No. 1 as she ran in her later years, a handsome and familiar engine indeed

It is now many years since one could stroll on to the familiar arrival platform at 'King's Cross and watch a stately "eight-footer" slowly drawing up at the head of a G.N.R. express train. Very majestic one of these engines then appeared, her great shining connecting-rod still gently swinging up and down; a movement which somehow or other brought to one's mind the opposite kind of picture, when at high speed, and far away in the level country, the same rod had been flashing its way so fast that the eye could scarcely see it distinctly. And now all was at rest. While the passengers thronged their way out from the station the great engine itself seemed almost to slumber. Not a movement, not a sound, nothing to indicate that mighty power pent-up inside, which, but a short while before, had caused the engine to resemble, in its headlong career, a veritable thunderbolt hurtling its way through space. For a moment or two the driver would stand in characteristic "G.N.R.-single" attitude regarding the stream of humanity which pressed on, anxiously intent on catching a "growler" or horse bus, and with little heed for the beautiful locomotive which had brought the train safe and sound those many miles. The driver still leant against the cab, his arm, raised to shoulder level, resting on the semi-circular beading which edged the graceful outline of his rather sparse shelter. This was the characteristic "G.N.R. attitude" (you may be able to recall many equally familiar poses of other lines). But not for long. Suddenly he steps on to the platform, and wiping his hands the while on some waste, begins a highly technical chat with his guard. Meanwhile, we edge nearer No. 1 herself and, conscious of the warmth from her smokebox sides and the smell of hot oil from her big cylinder and gleaming piston-rod, start a little survey of her interesting details. Peeping inside the red main frames, we note the great length of the eccentric-rods. As the cylinders are outside, the space between the frames strikes us as singularly empty, so we have a look at the exteriors. What a finely-shaped crosshead! The long 6-ft. 11-in. connecting-rod is delicately tapered, its big-end quite a large affair. The oil-cup on top catches our eye. Square in plan, the brass lid which screws into it, and is retained in position by a taper pin, is also square in shape. Rather unusual, this. The hexagonal nut cast on top has a circular hole drilled through it, for the reception of lubricating oil, and is closed by a ball-headed plug kept tightly upwards by a spiral spring surrounding the interior oil-pipe. Strolling

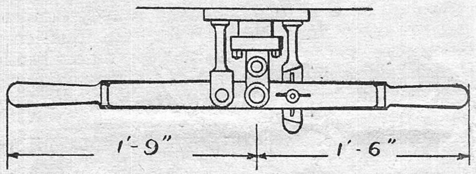


No. 1's first tender was a solidly built affair, and matched her engine nicely



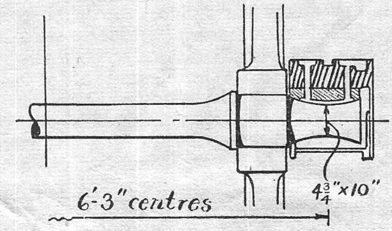
Original layout of the Stephenson gear. The centre line of the valves was half an inch below axle centre, whilst that of the cylinders was offset half an inch above!

towards the rear, we pass the great splasher, ornamented with its 2½-in. brass band encircling a thin painted black margin, the latter again separated from the green paint by a fine white line. And what a beautiful grass-green it was with which Stirling adorned his admirable



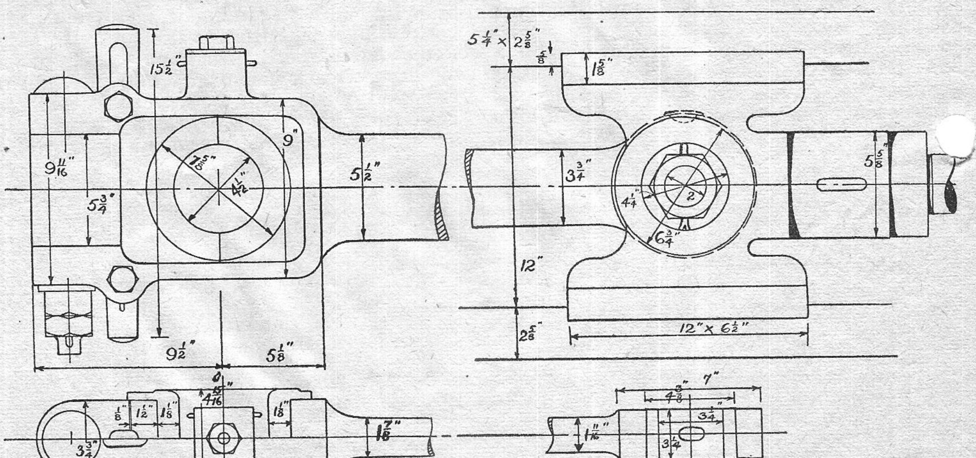
Plan of the "pull-out" regulator handle. It was handy for both driver or fireman

engines! Below the huge splasher comes the works' plate, black with white lettering, attached to the 3½-in. outside angle-framing, in its turn painted chocolate, with a black edging and thin red line between the two colours. Our gaze turns beyond all this to the cab, exceedingly pleasant in outline, but very shallow in depth. Not much shelter to be gained from that, one imagines. But enginemen are a hardy set, and at this time quite accustomed to roughing it behind a mere



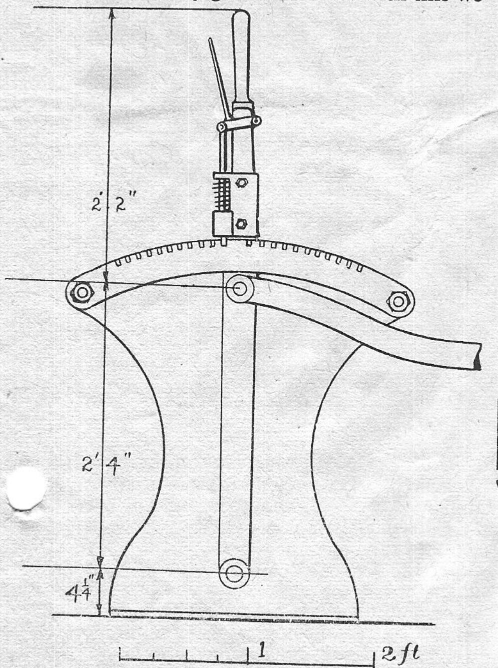
The curved journal of the tender axle was a typical Stirling feature of design

weatherboard with no vestige even of a roof! Such meagre protection is a commonplace. You recollect this typical arrangement in my drawing of the little L.C.D.R. tank No. 145? Some good locomodeller points out that this is an error in draughtsmanship, but, alas! he has confused, as



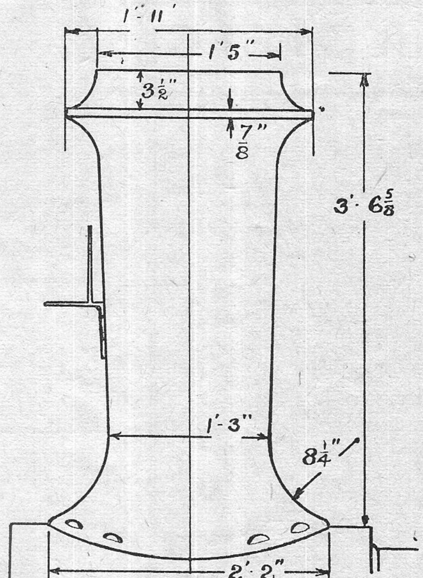
The jawed big-end, crosshead, and small-end of the connecting-rod were well designed, and remarkably like those of modern G.W.R. engines

so many do, the 145 class with two other very similar L.C.D. classes, both fitted with cabs—the 59 to 64 set with rounded-topped tanks, often seen in London, and the 71 to 74 lot with square-topped tanks, which worked mostly in the Canterbury district. A very natural mistake, of course, since all three classes were otherwise much alike. But to return to our inspection of No. 1, which during this digression has been standing quietly and patiently by. The gilt letters and numeral on the cab side-sheet stand out well, being shaded in red with fine white strokes. The tender, too, with its high sides and excellent proportions, is worthy of its engine. We cannot see the gleaming alarm bell, as this is on the right-hand, or driver's, side of the tender, nor can we see the springs which are concealed between the double plating forming the outside frames. These, by the way, are separated by great baulks of timber, 11 by $6\frac{1}{4}$ in., a massive "Sandwich" frame indeed—to say nothing of an inner frame, 11 by 4 in., as well! The outside axleboxes have curved brasses to fit a type of bearing much favoured by Stirling during his long career on the G.N.R. In this particular design the journal has no collar to check lateral thrusts, the concavity of the bearing surface providing the necessary guidance. And with this we



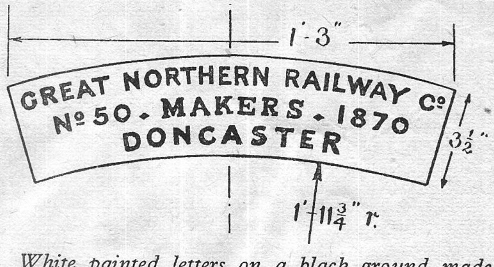
The reversing lever had a sector plate of 22 notches, placed high above the fulcrum

regretfully finish our little tour of inspection. A lovely ensemble, indeed. In all, 37 engines were built, more or less, to the general design of our famous No. 1, but the last eight of these (Nos. 664 to 671) had the boilers pitched higher, with the centre-line standing 7 ft. $3\frac{1}{2}$ in. above rail level, and also with the larger 4 ft. $7\frac{1}{2}$ in. trailing wheel, which had been originally introduced on No. 544,



Cast-iron chimney of No. 1, which replaced the earlier "built-up" pattern

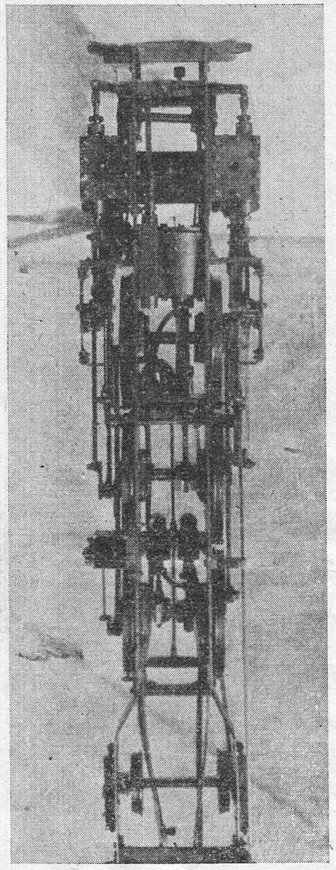
the eighteenth engine of the class. In due course No. 1 herself received the later modifications, and in 1880 appeared with the longer trailing wheelbase of 8 ft. 8 in. and the larger trailing wheels. But what struck the eye most, perhaps, was the change in safety-valve cover (this was necessitated by the new Ramsbottom safety-valve) and the cast-iron smooth chimney, with its "special train" headlamp-iron perched up on high! My drawing of No. 1 shows these alterations in appearance, and presents her as she ran for years on the main line. Her tender, too, was changed for one of similar type, but with higher 4 ft. 9 in. sides, and fitted with three coal rails, and also with the vacuum brake and cast-iron

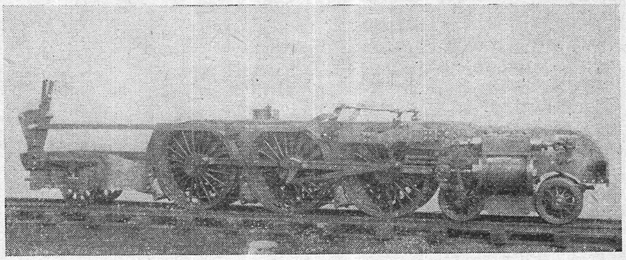


White painted letters on a black ground made an attractive works' plate which was attached to the angle-frame of the footplating

brake-blocks. One hesitates to make a final choice between the two phases of her existence. Both have their charms, the earlier one, with its tall chimney, bearing the sprightly form of youth; the second, a more mature and dignified engine, and oh! so very familiar to a later band of Stirling enthusiasts. Now, which would you choose, good locomodeller?

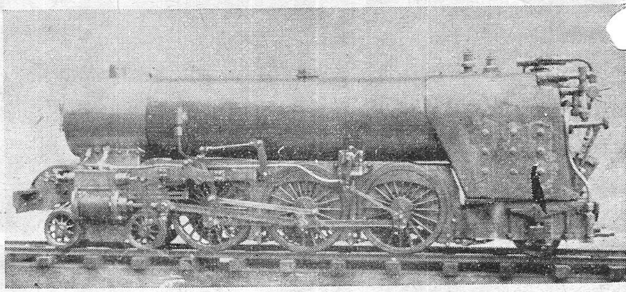
PACIFIC

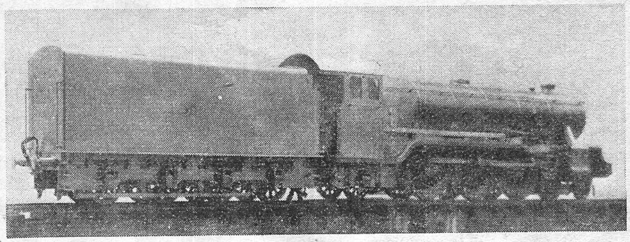




PROGRESS

SHOWING D. UNWIN'S $2\frac{1}{2}$ in. GAUGE L.N.E.R. 4-6-2 LOCOMOTIVE





IN one of his popular lobby chats, " L.B.S.C." mentioned the possibility of a $2\frac{1}{2}$-in. gauge " Hielan' Lassie." I thought readers might be interested in a 3-cylinder Pacific I completed in 1938.

The general design roughly follows the L.N.E.R. Pacific, the greatest departure being the substitution of Baker gear for Walschaerts.

Gresley 2 : 1 gear, fitted in front of the cylinders and driven by extended valve-rods, operates the inside valve.

The three-cylinders all drive on the middle axle, the inside bore being inclined to clear the front axle. The inside valve slides on a vertical port face and is not inclined.

The cylinder bores, which should shock any member of the " society of scale bores and small porters," are 1 in. diameter, equal to a full-size of 24 in.

Even these three large bores do not drain the boiler, which is an extremely fast steamer and blows off at the slightest provocation. It has an " L.B.S.C." type combustion chamber w[ith] tubular cross stays, and twin superheaters, ea[ch] in a $\frac{5}{8}$-in. diameter tube. Boiler fittings include a vacuum brake ejector as well as the usual water gauge, blower, etc. A 7-in. chime whistle is hidden under the right-hand running-board.

The trailing wheels are carried in radial axle-boxes, the front bogies having independent springing. Working vacuum brakes are fitted to both engine and tender.

All sheet-metal work, including the tender, is stainless-steel matt finish, This gives the engine, which is unpainted, a rather clean look.

She is a powerful puller, and accelerates rapidly with large loads.

The time taken to construct her may be of some interest to readers. 505 hours were taken to build the engine, and 65 hours for the tender, the whole being spread roughly over two years.

* MILLING IN THE LATHE

By "NED" **Section 4—Rotary Spindle Milling Attachments**

A general review of the principles, appliances and methods employed for adapting the lathe for various types of milling operations

ALL the milling operations so far described have been carried out by using the lathe mandrel as the cutter spindle, and the lathe slide-rest, or attachments mounted thereon, as a means of holding the work. Generally speaking, this method is the most efficient, particularly for the heavier classes of work, because the lathe mandrel is well adapted to withstand the stresses imposed in milling, and can also transmit a fair amount of power, at speeds varying over a wide range, without involving any difficulties or complications in the way of driving gear.

Most kinds of milling can be dealt with in this way, but occasions arise where it is more convenient to hold the work in the lathe chuck, or between centres, and carry the cutter on an auxiliary spindle mounted on the slide-rest. This method is particularly applicable in such operations as gear-cutting, or other work involving indexing, and one of its practical advantages in this case is that gear blanks or similar components, which have been turned in the lathe may be milled at the same setting, thus eliminating any possible risk of concentric inaccuracy in the milling. In some cases, rotary-spindle milling attachments may be used on work which is not carried on the lathe mandrel. This, again, permits of two alternatives; either the work may be mounted on the lathe bed, and the cutter spindle on the slide-rest, or *vice versa*.

Some forms of rotary-spindle milling attachments are designed to mount on the top slide of the lathe, or on the vertical slide (according to whether or not vertical adjustment is necessary for a particular operation) while others, of more elaborate design, are equipped with a mounting which incorporates elevating gear. It is not possible to say offhand which is the more desirable; much depends on individual details of design and construction, but it is reasonable to expect that a mounting designed expressly for the purpose of carrying the cutter spindle may be better adapted to this purpose than a vertical slide, which must cope with a wide variety of duties, and thus embody features which represent a compromise between various incompatible factors in design.

*Continued from page 459, "M.E.," November 7, 1946.

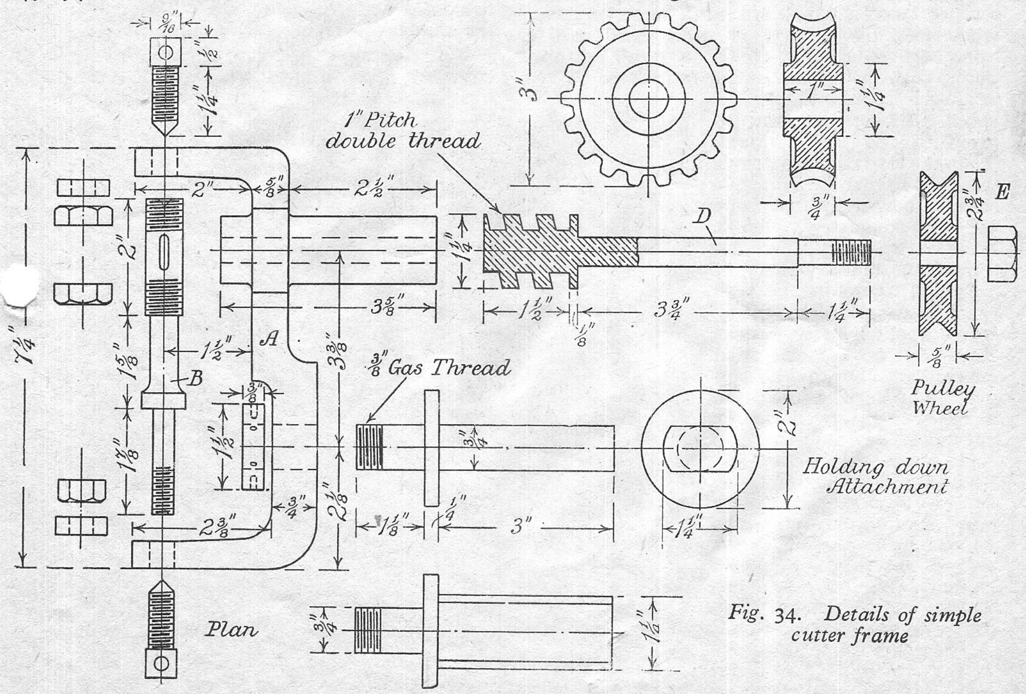


Fig. 34. Details of simple cutter frame

Simple Cutter Frames

The simplest form of rotary-spindle appliance is the "cutter-frame," which is an inheritance from horological practice, and is quite useful for light work, such as the cutting of small spur wheels and pinions for instruments. In its original and primitive form, the spindle is mounted in centre-point bearings, and is designed primarily to carry single-point flycutters, though in any case it may be adapted to use multi-toothed cutters, which are much to be preferred when working in steel or other hard metals. Such cutters, however, are liable to call for more power than fly-cutters, and may have to be run at lower speed, so that a speed-reducing gear must be fitted to the cutter frame. Then the load on the bearings increases so that the primitive form of bearings cannot cope with it adequately, and it becomes necessary to design a more substantial bearing.

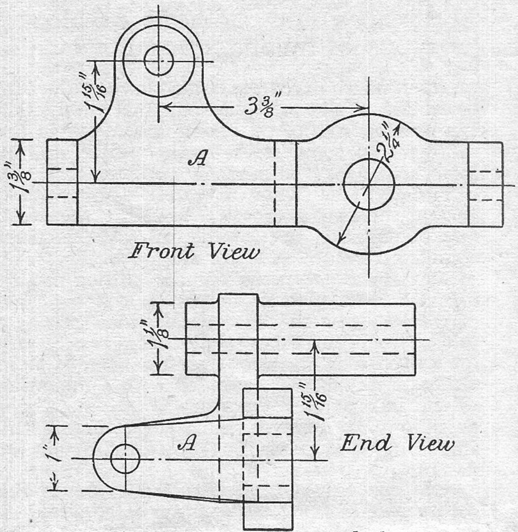


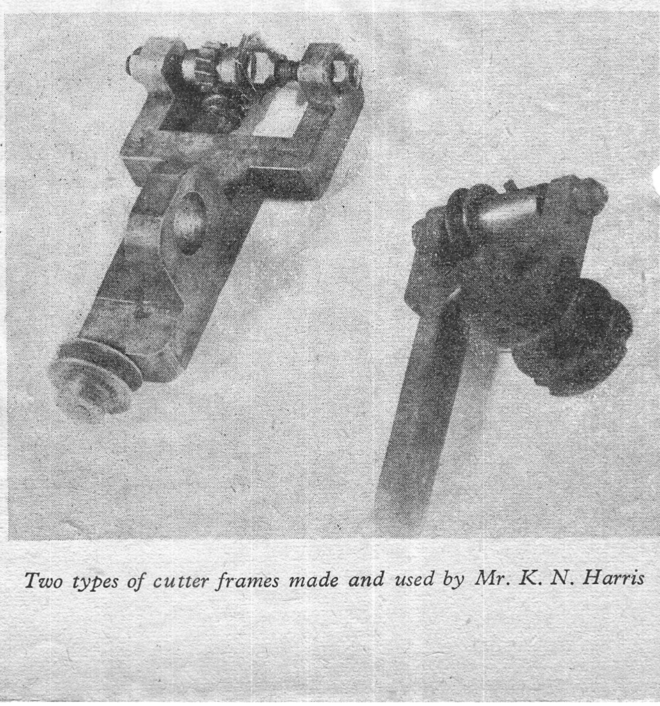
Fig. 35. *Detail of frame body*

It will, therefore, be seen that the simple cutter frame, when applied to a heavier class of work than that encountered by the horologist, is liable to evolve into a much heavier and more elaborate device; but in some cases this policy has been carried to extremes, so as to produce a clumsy and cumbersome appliance which may possibly have greater rigidity and power capacity, but is much less handy and adaptable than the primitive form of frame.

The cutter frame illustrated in Figs. 34 and 35 is primarily intended to be carried in the tool-post of the lathe. It is equipped with a worm gear drive giving a reduction of 9 to 1, and is adapted to take small milling cutters of standard type. The frame may be cut or forged from solid mild steel, or cast in good quality iron, and unless it is intended to be used permanently in the vertical position, the mounting shank must be provided with means to allow swivelling movement. As shown, the shank is flattened for clamping in the tool-post, and the other end is turned to fit a hole in the frame, where it is secured by a lock nut on the inner side. An alternative and perhaps better, method would be to make the shank a permanent fixture to the frame, and circular in section to fit a split clamp holder, as employed for boring bars. The spindle ends are centred as deeply as possible, and both these and the point centres must be case-hardened and polished. Lock nuts are provided to enable the centres to be secured, after adjusting to run freely with the minimum clearance. They may also be used as a means of height adjustment, to centre the cutter on the level of the lathe centres, possibly in conjunction with spacing bushes or washers on the spindle.

A gunmetal worm wheel, in conjunction with a case-hardened steel worm, will give satisfactory results, and the ration of reduction may, of course, be varied to suit the nature of the work being handled; it is also practicable to fit a multi-step cone pulley to the worm spindle to enable a range of speeds to be obtained. The provision of jockey pulleys, to adapt the drive to work from available driving gear, is often necessary, and a convenient way of mounting the jockey spindle is on a bracket clamped to the boss of the worm shaft bearing. (This matter will be discussed more fully in the section dealing with the means of driving cutter spindles.)

When using a cutter frame of this type to cut small gears, it is usual to mount it with the



Two types of cutter frames made and used by Mr. K. N. Harris

spindle axis vertical, and the cutter centre level with the lathe centres, so that it cuts horizontally across the front side of the gear blank. For feeding towards the chuck, the spindle should run anti-clockwise, viewed from above. Many other positions and arrangements of the frame, however, are possible, and may be exploited with advantage in dealing with various milling problems. Spur or bevel reduction gearing is sometimes used as an alternative to the worm gearing, but does not permit of such a large ratio of reduction in a single stage. Another advantage of worm gearing is that it enables different gear ratios to be obtained with little or no alteration of gear centres.

The photograph shows two simple cutter frames made and used by Mr. K. N. Harris, the one on the right having a plain, direct driven spindle, intended only to carry fly-cutters, and provided with a jockey pulley bracket. The frame on the left is equipped with worm reduction gearing, and the spindle takes multi-toothed milling cutters. A lug is provided on this frame, with a hole to fit the tool-post stud, whereas the other frame has a square shank to clamp in the ordinary way.

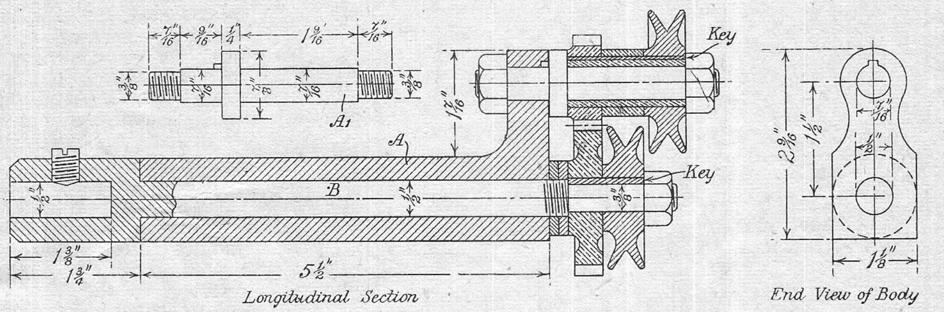


Fig. 36. Simple milling and drilling spindle

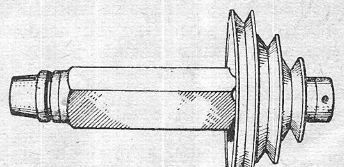
Milling and Drilling Spindles

The provision of a really substantial bearing, with adequate lubrication, is a great advantage, especially when the spindle is subjected to frequent or continuous running under heavy load. It is, of course, possible to provide the simple [illegible]er frame with improved bearings. Sometimes [illegible]s is done by making the spindle hollow, and running it on a long bolt passing right through between the horns of the frame. Generally, however, it is better to extend the spindle and run it in bearings carried in the horns of the frame; these usually have to be of the split "plummer block" type, in order to allow of removing the spindle for fitting the cutter in position.

In recent years, a form of cutter spindle, having a long bearing in the centre, and with the cutter fitted at one extremity, and the pulley or gearing at the other, has become extremely popular. Appliances of this nature are usually termed "milling and drilling spindles," because the open-ended spindle obviously provides facilities for using it to carry drills—also, incidentally, end mills, which cannot be used in the ordinary cutter frame. If the bearings of the appliance are well designed, this form of device works extremely well, and may be equipped with a hollow spindle with a Morse taper socket to carry taper shank drills and cutters, or bored for standard split collets.

A very simple milling and drilling spindle, having provision for either direct drive or spur reduction gearing, is illustrated in Fig. 36. It has a plain socket to take ½-in. shanks, secured by a grub screw, but may obviously be adapted to take other methods of fitting. If desired, the lug which carries the spindle for the reduction gear pinion may be extended and slotted to allow of mesh adjustment for gears of different sizes, so that the lathe change wheels may be used, in various combinations, to produce the required reduction ratio.

The body of the appliance may conveniently be made from a casting in iron or good quality gun-metal, which will provide quite a good bearing for the steel spindle, without bushing, provided that it is bored to a really good fit throughout its length, and is kept well lubricated.



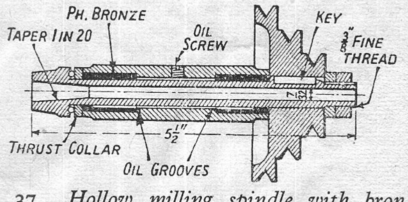


Fig. 37. Hollow milling spindle with bronze-bushed steel housing and ball thrust race

It is an advantage to "chamber out" the centre of the bore, or slightly reduce the diameter of the shaft, to leave an annular space which serves as a reserve oil well, and helps to keep up continuous lubrication on runs of long duration.

Another simple milling and drilling spindle is illustrated in Fig. 37. The body of this appliance is made of square section mild steel, and it is,

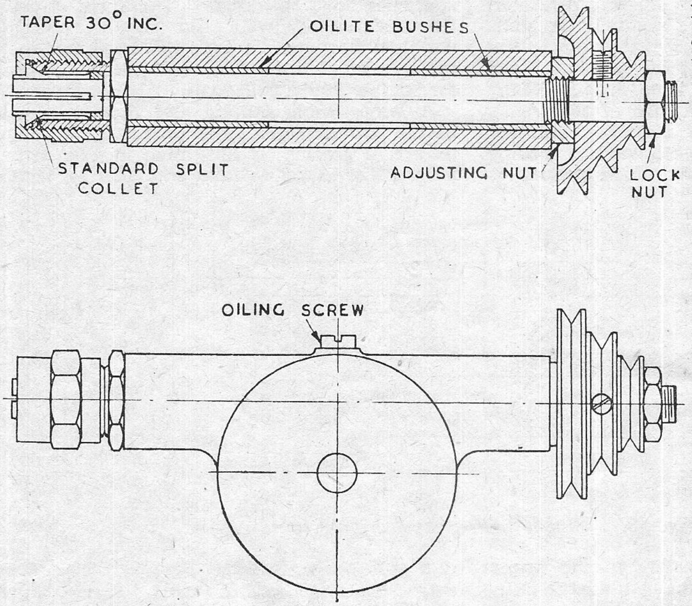


Fig. 38. *Milling and drilling spindle with push-in collet chuck and offset clamping pad*

therefore, advisable to fit bronze bushes for the bearings at either end. A three-speed cone pulley is fitted to the spindle, which is hollow, and provided with a taper socket, also a ball thrust race. End play is taken up by adjusting and locking collars at the pulley end. This type of spindle demands very careful workmanship if its potential advantages are to be realised, and the spindle may, with advantage, be hardened and ground on all working surfaces; but if these conditions are observed, it will give excellent service.

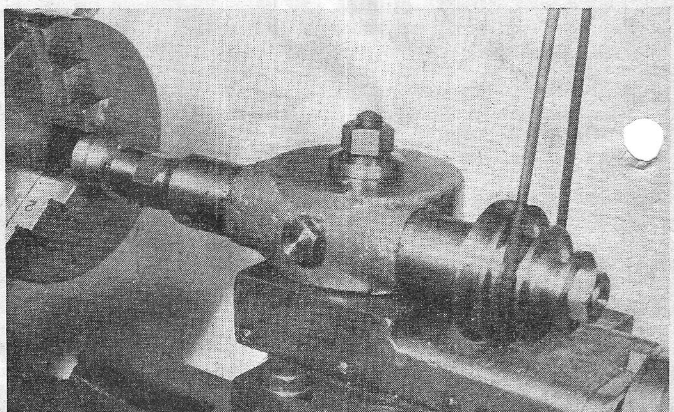
One disadvantage in this and also the preceding type of appliance, both of which are designed so that the bearing housing is clamped in the tool-post, is that the latter may become distorted by the clamping pressure, and thus bind on the shaft. To avoid this, it is better to provide a lug or other extension which will take the strain of clamping, leaving the bearing quite free.

This has been done in the appliance shown in Fig. 38, in which the body consists of a casting having a solid central disc, and an offset barrel, which is bored to take the spindle bearing. The disc is drilled in the centre to drop over the tool-post stud, and its thickness is adjusted so that when placed either way up, or in any angular position, the axis of the spindle is always exactly at the same height as the lathe centres. It is thus very useful for diametral or angular drilling, or for milling exactly across the centre of a piece of work held in the lathe chuck; it may also be used as a contra-rotating drill spindle, to obtain the effect of increased speed when concentric holes of very small size are required in turned work.

The bearing housing of this appliance is unusually long, and is fitted with two parallel Oilite self-lubricating bushes, with a large oil reservoir in the centre. A simple collet chuck of the "push-in" type is fitted, the end of the spindle being screwed with a fine thread to take the cap of the chuck, and the taper socket for the collets was bored while the spindle was running in its own bearings.

One purpose for which this spindle was specially intended was for the drilling of a number of holes equally spaced around a circle, as, for instance, a bolting flange or indexing plate, and it has proved extremely useful for this purpose, but it is also applicable to any milling or drilling work within the capacity of a directly-driven spindle in this class.

(To be continued)



The milling and drilling spindle, as shown in Fig. 38, *in use on a Myford ML4 lathe*

J. Ash (Kent M.E.S.)

Comments on the "M.E." Exhibition

VINCENT SQUARE once again! To modellers the very mention of that name means but one thing—THE MODEL ENGINEER Exhibition.

Eight years have passed since we were last there, and we wonder if it will be better than the last show. All through the dark days of the intermediate years, modellers have contrived in some way or another to carry on with their hobby, be it at home or abroad, and we are anxious to view their efforts.

Our venue this year is the new Horticultural Hall, and though it is half an hour to opening time, crowds are already gathered in readiness to view what must be London's number one show.

One is thankful that our steward's badge enables us to enter early and snatch a preview in the comfort of a nearly deserted hall, but this of necessity must be short, as we have to open the club stand and prepare for the fast-increasing number of visitors. Having arranged our duty rota, we set out on our tour of the competition section proper, where exhibits are arranged in the centre of the hall, but we are a trifle dismayed as we note that the entries are not so numerous as we have seen in previous years. Model engineering did not stop even in the war years, and it must be the feeling that his work is not up to competition standard that has kept many a hobbyist from showing his efforts.

It can safely be said that the show has not produced a really outstanding piece of work this year comparable with the previous exhibitions. All credit is given to the championship winner for his very fine effort, but we do not think this type of model appeals to a large circle.

Locomotives are still a popular subject for construction and some very nice examples were on view, including the smaller gauges. The Cup winner in this section had a very powerful four-cylinder job, nicely made but rather spoiled, we thought, by the use of screws in place of rivets, especially round the smokebox. We also welcomed the entry from a lady competitor in this section, whose success in gaining the Admiral's Cup will, we hope, encourage more entries from our lady members.

Our interest was aroused by the very fine entry of machine tools and accessories, far more numerous than previous displays. The Championship Cup recipient more than deserved his award, the quality of his work, and design, being beyond praise, though we would extend our congratulations to the exhibitor who showed us how to turn what must have been one of the cheapest lathes ever into a real precision job.

This year also has given us some very fine examples of the road roller job, the designer of these being very well known to all, and staged in company with those old-timers the traction engines; some very fine examples of which were to be seen, particularly that built to 2-in. scale.

Undoubtedly the most fascinating piece of work was a very nice specimen of the Congreve clock, which puzzled visitors as to how it obtained its energy of movement, which reminds us of a similar clock in a previous exhibition which provided a never-ended source of interest throughout that show.

Upstairs in the gallery we find a varied collection of models, ranging from the very fine model of the Sprowston windmill, the unique model of a super cinema complete with music and lighting effects, though it was a pity that this exhibit was not able to give its usual programme of films. We think it would have been practical to have shown silent films of club activities and general interest and any such programme very much appreciated.

A very fine layout of "OO" gauge track and rolling stock completed the main features here, and the interest aroused in the layout emphasises the enormous following that this type of modelling has with the public.

Our descent of the steps of the gallery was made with some difficulty, as by this time quite a number of visitors, especially the ladies, had fallen by the wayside and the complete absence of any seating accommodation had led them to invade the bare comfort of the steps for a rest.

We would commend this point to our organisers so that in future years we may be able to offer our ladies the comfort of a seat while we endeavour to give every exhibit a thorough viewing.

The energies of the members had made the various club stands a focal point in the show.

We were amazed at the diversity of talent, and, be it confessed, very near to breaking the Tenth Commandment when it came to some of the show pieces. There is no doubt that the club member is the backbone of the show, and definitely more space, including the provision of a reasonable width of gangway between stands should be allotted to the various societies, whether affiliated or not.

The parent society, in our opinion, could give a lead in this matter in releasing some of its considerable amount of space in favour of other clubs. Our tour of the trade stands revealed gaps in the ranks of the model supplies. Two firms in particular whose wares were a great attraction to visitors were badly missed, and the ample display stand, always very popular, is also no more.

Among those who showed, there were only two machine tool manufacturers, both of whom, however, had all the enquiries they wanted, and we notice that only one material supplier had taken space, though it should be said that no MODEL ENGINEER Exhibition would be complete without him. Petrol engine manufacturers were well represented with a very nice range of products, but it will be very interesting to see how many of them weather the vagaries of the model trade.

(Continued on page 507)

MADE AT SEA
A TOY TRACTION ENGINE
by E. G. HOBSON

THE idea of making this simple 1 in. scale pull-along traction engine first occurred during a leisurely passage from Brazil to Africa. Some of us on board were discussing the insane prices charged ashore for rubbishy toys, and knowing that a shipmate's two small sons were traction-engine enthusiasts, I started to make them something a little more realistic along these lines.

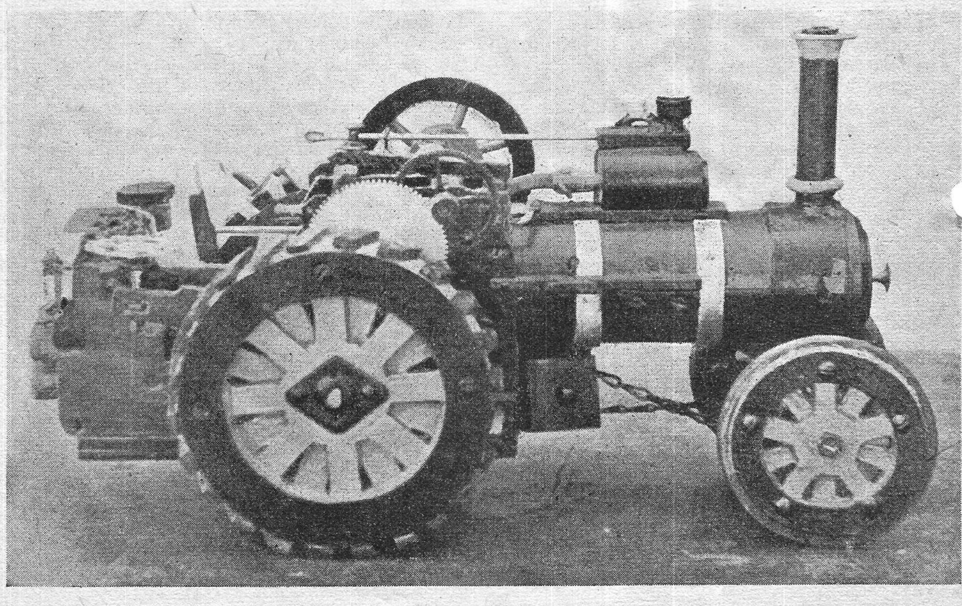
The boiler was cut from a length of lifeboat oar, condemned for service, but still a bit of sound ash by toy-maker's standards. The smoke-box was formed from a layer of cylinder-jointing wrapped round the front end, and the barrel was then screwed to a box-like wooden structure which represented firebox, horn-plates, coal-bunker and tank.

The cylinder and piston were a hardwood bobbin and plunger, once part of a patent raft-light. The crankshaft, built up from brass plates, " beheaded " ¼-in. bolts, lock-nuts and washers, ran in drilled metal frames which reinforced the wooden " horn-plates " to give a better bearing surface on each side. All plates were secured by cycle bolts, lock-nutted. Strength was a great consideration, and " L.B.S.C's." friend Inspector Meticulous was not on board—deterred by sea-sickness, perhaps !

For the same reason, the dummy valve-gear was a simplified version of the real thing, but it moved in and around the wooden " steam-chest " in quite a convincing way when the flywheel revolved. The rim of the latter was sawn out of a piece of ⅝-in. board, cut in ring form with a fretsaw, and the boss was a short section of broomstick. They were joined by six brass spokes screwed into both boss and rim, the whole thing being assembled in a simple jig and then secured to the crankshaft by a cotter pin.

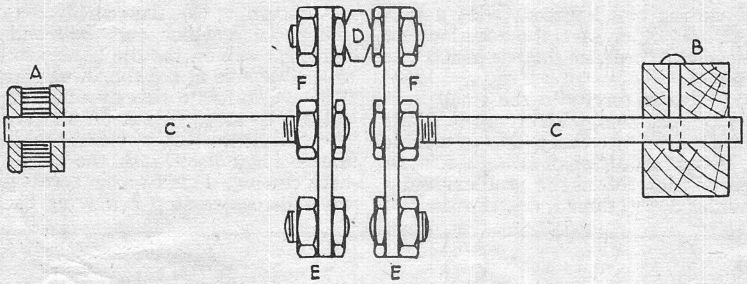
I was determined to have a proper 3-shaft transmission, such as was used in the Burrell, Wallis, Green, and other famous makes, but an attempt to produce wooden cogs on board ship wasted many hours. At last I had to buy old brass gears from a clockmaker in Durban ; they were a sturdy assortment which meshed-up well. The larger ones had brass flanges brazed to them, and when these were prised off I found that they exactly fitted round the boiler barrel, so here was another problem solved.

The back axle was made from a piece of metal towel-rail, and the 3rd motion gear, and the winding-drum were attached to it by split-pins ; drilling the various axles and shafts to receive these pins with only a small hand-drill was the worst part of the whole job. The drive between wheels and axle was conveyed through slotted discs and pins, which gave a modified differential action of about a quarter of a turn to each rear wheel ; I believe a device of this kind was actually in use in the 'nineties. A removable hub-pin was provided, so that a cord round the winding drum, when pulled out smartly, drove the motion as a stationary engine for " threshing."



Each back wheel was made of five circular sections of wood, all 6 in. diameter and $\frac{1}{4}$ in. thick, bolted together so that the complete wheel was $1\frac{1}{4}$ in. wide. There was an outer ring, an outer spoke section, then a middle ring, then an inner spoke section, and lastly an inside ring. Front wheels, $3\frac{1}{2}$ in. diameter, were made in the same way, but with only four sections of thinner wood, making them $\frac{3}{4}$ in. wide. After assembly they were trued up in a lathe improvised from an old breast-drill. The wheels are a little clumsy, but they are actually more correct than many toy wheels, and here again strength was needed to resist hard treatment, the common lot of all toys for youngsters. The strakes on the back wheels and the tyres on the front were of strip rubber used for packing ship's portholes. They are both glued and pinned to the wheel rims.

The steering worm and pinion, over on the left of the engine, came from an old electric fan. The chain barrel, carried in brass brackets, was cut from a length of dowelling, the steering chains being ordinary brass picture-chain. These are adjustable for wear by nuts and washers, and the whole steering gear works quite effectively. The front axle was fitted with a trunnion device on the centre pivot so that either front wheel can rise over an obstacle as in actual traction-engine practice. The 5-spoked steering wheel and brake wheel were clock gears with the teeth filed off and then fitted with a winding-handle. The brake acts on the slotted hub-disc of the off-side driving wheel and locks the whole engine when it is screwed well down. Reverse lever, throttle and gear handle, though movable in quadrants and "located" by brass pins, are all "dummies," but the coal in the bunker is real coal, washed, set in putty, then varnished over. Draw-bar gear, fairleads for the winding rope, a steersman's seat, and lamp-irons, were added later with some other details. The chimney cap was one of the large brass eyelets used in ship's tarpaulins.



Built-up crankshaft for model traction engine

A. Lantern pinion.
B. Wooden flywheel boss.
C. $\frac{1}{4}$-in. bolts with heads sawn off.
D. Con-rod "big-end."
E. Balance weights made from nuts.
F. Brass crank webs.

The boys' father looked after the paintwork, and made a very fine job of it. Boiler and bunker are dark green, wheels and part of the motion are dark red, tyres are grey, and the rest dull black. The engine is about 19 in. long, and 10 in. to top of chimney, and weighs over a stone. When drawn along, the motion runs smoothly and rapidly, with just a slight clatter to make it sound convincing. The two owners polish the brass and wash the paint every Saturday morning, so in this atomic age there are evidently still some youngsters who are interested in the friendly, peaceful old traction-engine.

"M.E." Exhibition Comments

(*Continued from page* 505)

Of the rest, we mention the Royal Navy and Royal Air Force stands, both very instructive in dealing with full-size practice jobs forming the trade tests of their personnel, but it is rather difficult to associate the exhibits of some of the other stands with model engineering—we have in mind those offering what were more or less toys, and we would rather see the space occupied put to some advantage.

Visitors from the provinces rather count on examining the advertised products of the model suppliers at the show, and we think in future stand space should be allotted on this basis.

Model aeroplanes, both flying and solid scale, attracted a considerable amount of attention, round-the-pole flying being something new to the majority of the public, and the release in the hall of uncontrolled flight planes evoked roars of laughter when the plane, heading for certain disaster, lifted itself over the obstacle and continued in flight.

Altogether, we thoroughly enjoyed ourselves at the show, met quite a few old friends, and made some new ones whom we were able to help in their requests for information as to clubs and supplies. And we feel it was worth all the sweat and toil of those intervening years that we might have another MODEL ENGINEER Exhibition, and, having seen the 21st several times, we are looking forward to 1947.

F. MASSEY DESCRIBES
CUTTING SMALL THREADS

WHEN cutting small threads with a tailstock die holder, several precautions are necessary to produce threads of full size and correct form.

I have made 45,000 screws in the small B.A. sizes to aircraft standards with a tailstock die holder, and at first ran into every kind of trouble imaginable. It was just a case of a careful analysis of every aspect which solved the problem and I can now shoulder down, thread, unscrew die and part off a small B.A. screw in nine seconds on my forty-year-old Drummond.

I would class the troubles into three groups :—

(1) Irregularities in the dies.
(2) Inaccuracy in alignment.
(3) Faulty lubrication.

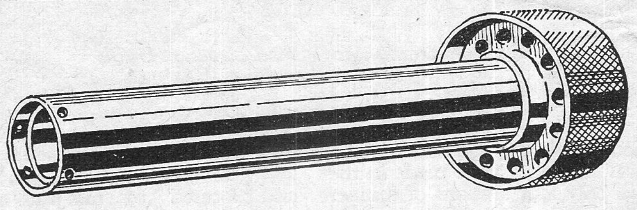
Irregularities in Dies

Irregularities in dies are as follows :—

(*a*) The hole is not always at right angles to the faces of the die.
(*b*) The hole is not often in the centre.
(*c*) The cutting edges are very often incorrect. (Even on new dies.)
(*d*) For average work the number of cutting teeth can be reduced.
(*e*) For threading up to the head of a screw there is usually too much lead in the ordinary die.
(*f*) The most important of all, the die is not sharp.

Dealing with these in order, regarding (*a*), test the die by screw-on a threaded portion of a screw before cutting off. Sometimes the wobble is amazing. I tried grinding them with the die mounted on a little mandrel, but gave it up, as the following way proved quite successful. The die holder was fitted with four securing screws and the recess for the retaining screw on the side of the die was ground out to a groove from back to front. (Even with a true die I always grind out this hollow, as it often prevents true seating by holding that side of the die away from the bottom of the recess in the die holder. Removal of this dimple is very important.) The four screws in the die holder are tightened after the die has aligned itself on the thread of the screw.

Concerning (*b*), the remedy for this is to find the position which cuts well and make a permanent mark on the die holder so that the mark will always be at the top when starting a thread. I have also found that by releasing the tailstock a little so as to free it on the bed of the lathe allows a little cross movement which permits the die to align itself with the thread and prevent back cutting. I clamp a bar across the bed behind the tailstock to stop it moving back and let my die holder, which slides directly on the tailstock barrel, almost come off the barrel at the end of the cut. I have found that if the dieholder is centred too much there is not enough freedom to be sure that the die can always be free on the thread when backing off.



Die-holder with hand-grip wheel

Regarding (*c*), cutting angles are corrected by grinding with a tiny mandrel mounted stock running at high speed. The little stone is dressed down with a piece of broken carborundum stone to $\frac{1}{8}$ in. diameter. A good light, a firm grip and a watchmaker's eyepiece are essential. Broken teeth at the front can easily be sharpened to the correct cutting angle by grinding the top of the tooth and leaving them like a lower step to the remaining teeth.

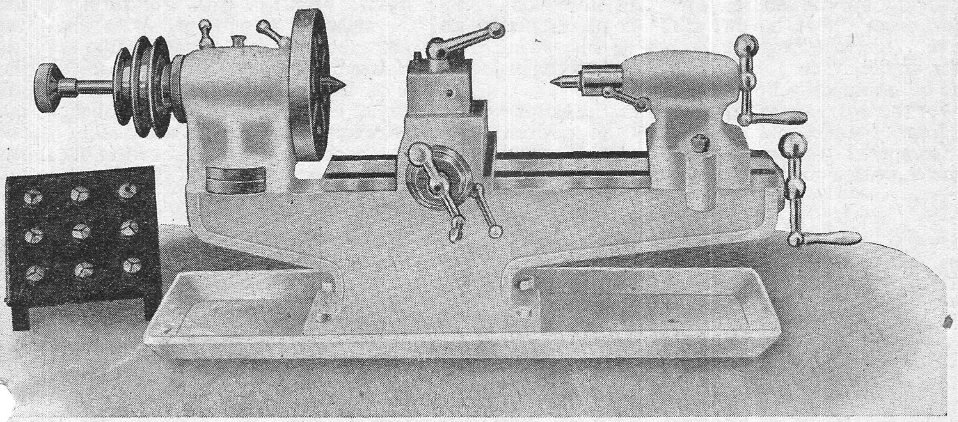
Regarding (*d*), it is possible that many will disagree with me on the matter of removing some of the teeth. I can only say that I have n... better success when dies are altered in this way.

Regarding (*e*), most of the screws which I have made have required a thread right up to the head, and none of the available dies would cut closely to the head. I ground about a $\frac{1}{2}$-in. diameter, saucer-shaped recess in the front face of the die to correct this. The edges of the big round holes must be chamfered off to prevent their sharp edges biting into the under-side of the head of the screw when the die hits the end.

Regarding (*f*), keeping a die very sharp makes a wonderful difference. It is amazing how freely a sharp die works even when cutting tough steel when the die is really sharp. I often sharpen a die ten times before it becomes useless through broken teeth, and during its life it may make about five thousand screws.

(*Continued on page* 510)

Interesting New Lathes

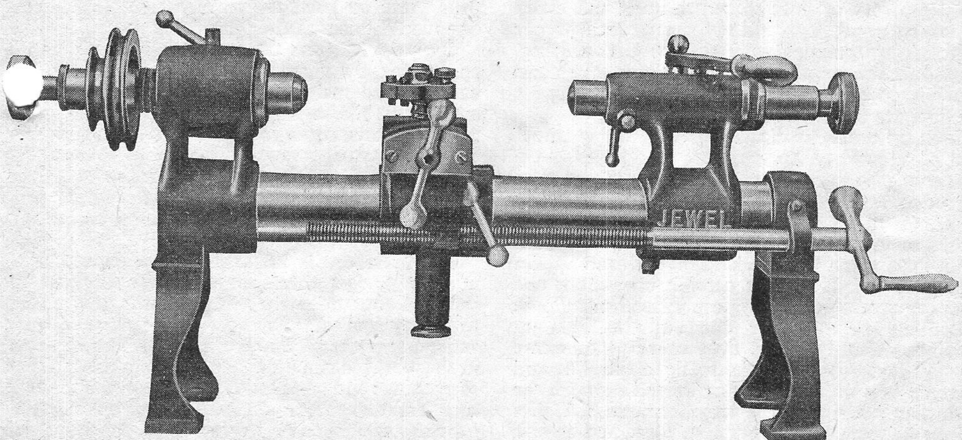


(*Photo by courtesy of "Mechanics"*)
The Coronet "Diamond" lathe

MESSRS. T. GARNER & SON LTD., 5, Sheffield Road, Barnsley, Yorks., have sent us particulars of the new Coronet lathes, which embody several interesting features of design, and appear to be soundly and accurately constructed. These were on view for the first time at the recent MODEL ENGINEER Exhibition.

The "Diamond" lathe is $2\frac{1}{4}$ in. in centre height, and the length of bed is 15 in., admitting 6 in. between the centres. It swings $3\frac{3}{8}$ in. over the saddle, and the hollow mandrel has a through diameter of 0.314 in., taper bored to take standard 8-mm. collets, and screwed $\frac{11}{16}$ in. by 20 t.p.i. on the nose. The headstock is detachable from the bed, and has a swivelling base, graduated 10 degrees each side of the zero line, to allow of taper turning in the chuck. A unique feature is the provision for quick removal of the entire lathe mandrel unit, which may be replaced by a special high-speed spindle. The tailstock is of the set-over type, marked for re-setting. All slides are hand-scraped, and the screws are machine-cut and protected, operated by ball handles, and equipped with index dials graduated to read in thousandths of an inch.

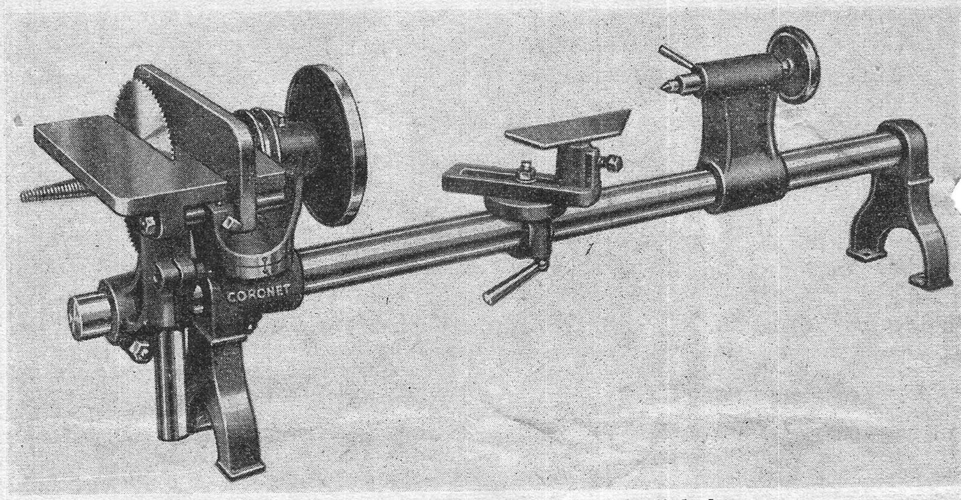
The "Jewel" lathe, of $1\frac{1}{2}$-in. centres, embodies several features in common with the above, including the detachable mandrel unit, and provision for taking 8-mm. collets. The tailstock has a sliding barrel with sensitive lever feed, which may be removed entirely to allow of long work being passed right through the bore of the casting. In the latest form of this lathe, the standard headstock mandrel has a taper bronze bush at the front end and a ball race at the rear; the special high-speed mandrel has a



(*Photo by courtesy of "Mechanics"*)
The Coronet "Jewel" lathe

ball-bearing at both front and rear ends. Swivelling adjustment is provided on the cross slide to enable taper turning to be carried out, and the swivel is locked by the hand clamping ball lever at the front of the saddle. The main dimensions, apart from centre height, are: length of bed, 12 in.; distance between centres, $4\frac{3}{4}$ in.; swing over saddle, $2\frac{1}{4}$ in.; bore of mandrel, 0.314 in., and bore through collet drawbar 0.200.

For the worker in wood or plastics, the Coronet "Home Cabinet-maker" will be of interest. It comprises a wood-working lathe of $3\frac{3}{8}$-in. centres, with a 30-in. bed, and a swivelling headstock, which enables a much wider range of work, and larger diameters, to be dealt with than is otherwise possible. The mandrel has a two-speed cone pulley and runs in large adjustable bronze bearings, with ball thrust at rear, and the tailstock is equipped with screw feed and removable centre. An adjustable saw table can be fitted, complete with fence, to take saws up to 6 in. diameter, and other items of additional or optional equipment include a polishing mop adaptor, extension piece, and saw table bracket. Other extra attachments are in course of preparation, and will be available in future.



The Coronet "Home Cabinet-maker" lathe

Cutting Small Threads

(*Continued from page* 508)

I have assured myself that it is a most important consideration for the die to run freely on the thread and owing to an accumulation of small inaccuracies the practical way has been to allow the die plenty of float to centre itself and avoid "back-cutting." I would say that at least 50 per cent. of my troubles were due to back-cutting. It produces sharp, thin threads, ragged finish and under-sized screws. The methods of allowing for the float are outlined in (*b*) above.

Even on brass, lubrication is very important if a lot of screws have to be made. And here is a tip for those who have to screw fine threads on thin copper tubes—try lubricating them with ordinary milk. (I mean cows' milk—in case anybody should misinterpret this as a colloquial term I am using for a mixture of cutting oil and water.) On brass screws I use either paraffin oil—about one drop per screw—or heavy sulphurised oil. Some brass likes one and other brasses the other. I am convinced that brass oil does more to lubricate the "valleys" between the teeth in the dies and prevents bits of brass getting lodged between the teeth than it assists in the actual cutting. B.A. dies especially seem to "pin" like files, and it is a sure sign of "pinning" when a screw comes off with a round-topped thread and anywhere from two to six thous. undersize. To remove the "pin," examine the die under a strong light with a watchmaker's eyepiece and dig out the offending piece with a strong steel hooked wire. The pins" are so hard to remove sometimes that one would imagine they are fused in.

On steel I always use heavy sulphurised oil. I apply this by vigorously brushing out the [illegible] between the making of each screw with a [illegible] stiff brush like a gloy brush. This cleaning-out process I have come to regard as a necessary evil. In making steel screws, it is wise to sharpen the teeth of the die with a particularly small stone in order to give a sharp cutting angle which produces a tightly-curled chip which can be cleaned out of the die easily.

Finally, there is no easy way or short cut to making perfect threads. Every detail must be watched, but once their importance is attended to screw making becomes a quick and very satisfying process. I now find it the easiest thing in the world to run off a lot of 5,000 in three weeks of evenings and get a lot of pleasure out of making them right up to size and form, as this business has proved a challenge to me as a mere model engineer whose daytime occupation is an accountant in a country bank.

SINGLE-PHASE TRANSFORMER DESIGN

J. L. WATTS

THERE are many occasions when an a.c. supply of different voltage to that of the supply mains is required and this can readily be obtained from a.c. supply mains through the medium of a suitable transformer. Direct current can also be obtained from a.c. mains through a suitable transformer and some form of a.c. to d.c. rectifier, such as a metal or valve rectifier. It is not always convenient to purchase a ready-made transformer of suitable capacity, and may be rather expensive to have one specially built to order. However, the design and construction of small transformers is a comparatively simple matter, and quite within the capacity of the model engineer.

Transformer Operation

The operation of a transformer depends on the fact that when an alternating current is passed through a coil of wire, termed the primary coil, an alternating magnetic flux is created through that coil. The strength of the flux created, by a given current and given number of turns, depends on the reluctance of the path through which the flux passes, being much greater for iron than air. The varying magnetic flux linked with the coil causes an induced voltage to act on the coil, this voltage having the value $\frac{4.44 \times S \times f \times \phi}{100{,}000{,}000}$, where S is the number of turns of wire in series, f is the frequency of the supply, and ϕ is the peak value of the total magnetic flux linked with the coil.

In the case of the primary coil, which creates the flux, the induced voltage opposes the applied voltage and thus controls the current which the coil draws from the mains. If another coil, termed the secondary coil, is placed to encircle the flux a voltage will be induced in this coil also, and this voltage can be applied to pass current through an external-load circuit. The value of secondary current passed to the load circuit will be equal to the secondary voltage divided by the impedance of the whole secondary circuit, including the secondary coil of the transformer. When the secondary circuit is closed the current will cause the secondary coil to create a magnetic field also and this opposes the primary field. In so doing it has the immediate effect of weakening the primary field, thus reducing the induced primary voltage and allowing the primary coil to draw more current from the mains. The increased primary current then restores the magnetic flux almost to the original value. Thus the current from the mains automatically increases with increase of secondary load.

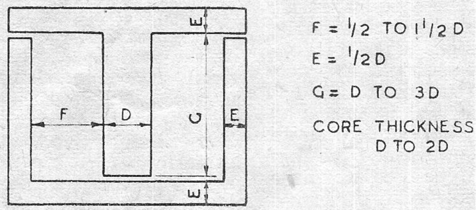


Fig. 1. Suggested proportions of core laminations for single-phase transformer

The secondary voltage has maximum value on no load, i.e. with secondary circuit open-circuited. With the secondary circuit closed and current flowing through the secondary winding the secondary voltage will fall slightly owing to the resistance and reactance of the secondary circuit. The resistance volt drop will be reduced with increased size of conductors, provided the length of the conductors is not thereby increased. So far as the secondary winding of the transformer is concerned the reactance is due to leakage of secondary magnetic flux, created by the load current, the leaking portion of the flux passing round the secondary turns alone, and not being linked with the primary windings. This cause of volt drop is reduced by fitting the primary and secondary coils close together, usually one on the top of the other.

Adequate Supply Mains

Dealing with the design of a single-phase transformer the first requirement, in the case of a fairly large transformer, is to ensure that the supply mains are of adequate size. The volt-amp rating of the transformer is equal to the product of volts and amps output required. Dividing the volt-amp output by the primary voltage, and dividing the result by the efficiency (say 0.85) will give the primary current drawn from the mains on full load. The mains current will, of course, be reduced on reduced secondary load.

The next step is to determine the size of core required for the transformer. The core is built of laminations of Stalloy or Lohys steel about 0.014 in. thick, the laminations being lightly insulated on one side. If the core was made of solid iron or steel there would be considerable eddy currents generated in this core, since it would act as a short-circuited secondary conductor linked with the magnetic flux; and the core would tend to heat up even on no load, causing the primary winding to draw an increased current from the mains and lowering the efficiency of the transformer. A core of insulated laminations is thus necessary to split up the core into sections of high electrical resistance.

The three-limbed shape of core indicated in Fig. 1 is usually employed, the centre limb carrying the primary and secondary coils. Each layer of laminations is generally made in two parts so the laminations can easily be threaded round and through the wound coils. Alternatively each layer may merely be split so that it can be bent round and through the coils. The outer limbs should be approximately half the width of the centre limb, since the flux from the centre

limb divides into two, one half passing down each outer limb. Various stock sizes of laminations are obtainable from Messrs. Joseph Sankey & Sons Ltd., Bilston, Staffs.; and from Messrs. Geo. L. Scott & Co. Ltd., Hawarden Bridge Steelworks, Shotton, Chester. It is best to have the centre limb of the core as near square as possible rather than rectangular, thus reducing the length and resistance of the wire necessary to encircle a given flux. For use on a 50-cycle supply the net cross-sectional area of iron in the centre limb can be found from the formula $A = \frac{\sqrt{\text{volt-amp output}}}{5.6}$ On a lower frequency the iron area should be increased in inverse proportion to the frequency. Ten per cent. extra gross core area should be allowed to include the insulation between the laminations. Convenient proportions for laminations are given in Fig. 1.

A suitable peak magnetic flux density (B) for the core is 60,000 lines per sq. in. The total flux (ø) will thus be equal to the flux density multiplied by the net cross-sectional area of the centre limb. The number of primary turns required per volt (T) $= \frac{100{,}000{,}000}{4.44 \times f \times \text{ø}}$, 5 per cent. extra turns per volt being allowed in the case of the secondary winding to compensate for volt drop on load. The sizes of wire chosen for both the primary and secondary windings can be based on a current density of 1,500 amps per sq. in. Enamelled wire can be used for sizes below about 18 s.w.g.; above this size double silk-covered wire is advisable on account of the greater flexibility of the insulation.

Suggested Wire Sizes

Table I gives details of the number of turns per sq. in. which can be accommodated using different sizes of wire, and also shows the current which can be carried by the various sizes with a current density of 1,500 amps per sq. in. Having determined the windings and cross-sectional area of core required, it is then advisable to calculate the winding space necessary, making adequate allowance for the bobbin, insulation, and assembly, before fixing the final dimensions of the core.

A suitable bakelite bobbin or former may perhaps be obtained from a firm such as H. Clarke & Co. (Manchester) Ltd., who deal in insulating materials. Alternatively a bobbin can be built up from stiff cardboard well shellaced, or from thin paxolin. If the laminations to be used are of the one-piece type with an assembly split, the length of the bobbin must allow for the laminations being passed over during assembly.

A wooden or other jig will be required to support the bobbin and its ends whilst the latter is being wound in a lathe or even in a wheel-brace secured in a vice. For most purposes the primary is best wound first. If fine wire is to be used a four-strand lead should first be formed on the end of the wire, this being drawn through a hole in the bobbin cheek. Care must be taken to wind the bobbin as evenly as possible. When enamelled wire is used it is advisable to wind a layer of thin paper (about 0.0015-in. thick) between each of the layers of wire, to allow for expansion and contraction with load heating, the enamel insulation not being very elastic. The primary winding should be covered with two layers of empire tape before proceeding to wind the secondary on the top.

TABLE I.—SUGGESTED WIRE SIZES FOR PRIMARY AND SECONDARY WINDINGS

Wire size, s.w.g.	Current (amps) at 1,500 amps/sq. in.	Advised wire covering	Turns per sq. in.
10	19.3	Double silk	57
11	15.8	„	69
12	12.7	„	85
13	9.9	„	108
14	7.5	„	139
15	6.1	„	172
16	4.8	„	213
17	3.7	„	272
18	2.7	„	376
19	1.9	Enamel	560
20	1.5	„	680
21	1.2	„	86[illegible]
22	0.92	„	1,110
23	0.68	„	1,510
24	0.57	„	1,775
25	0.47	„	2,120
26	0.38	„	2,560
27	0.32	„	3,120
28	0.26	„	3,760
29	0.22	„	4,390
30	0.18	„	5,380
31	0.158	„	6,060
32	0.137	„	6,890
33	0.118	„	7,900
34	0.100	„	9,610
35	0.083	„	11,250
36	0.068	„	13,450
37	0.054	„	16,400
38	0.042	„	20,400

When assembling the core it is necessary that the insulated sides of each lamination should face the same way, to ensure there is insulation between each layer. Adjacent layers of laminations should be reversed so the joints in one layer are covered by the next layer. The laminations should be tightly packed and clamped between strong metal strips to avoid vibration and noisy operation. The primary should be protected by fuses, which will melt at about twice the full load current. When a transformer has two or more secondary outputs it is an advantage also to connect fuses in circuit with each secondary winding.

As an example of design we may take the case of a transformer requiring an output of 2 amps at 80, 70, and 60 volts; and an output of 12 amps at 12 volts; the transformer to be supplied from 50-cycle mains at 230 volts. The maximum secondary output is thus $80 \times 2 + 12 \times 12 = 304$ volt amps. Primary current from mains at 200 volts $= \frac{304}{200 \times 0.85} = 1.78$ amps. Net core area of centre limb $= \frac{\sqrt{304}}{5.6} = 3.12$ sq. in. Allowing for insulation, gross area $= 1.1 \times 3.12 = 3.43$ sq. in. The centre limb could thus be 1.75 in. wide and the core 2 in. thick. With flux density of 60,000 lines per sq. in. the total flux (ø) will be

$3.12 \times 60{,}000 = 187{,}000$ lines. Turns required per volt (T) $= \frac{100{,}000{,}000}{4.44 \times 50 \times 187{,}000} = 2.4$ turns per volt. The total turns for the primary on 230 volts will thus be 552, and for 200 volts will be 480. Table I shows that 19 s.w.g. can be used to carry 1.9 amps, so the primary winding could have 552 turns of 19 s.w.g. enamelled wire, with a tapping or loop at 480 turns for use on 200 volts.

The secondary windings could have $1.05 \times 2.4 = 2.52$ turns per volt; the 80-volt winding thus having 202 turns of 18 s.w.g. D.S.C. wire with tappings or loops at 176 and 151 turns to give 70 and 60 volts respectively. The 12-volt secondary could have 30 turns of 12 s.w.g. D.S.C. The actual winding space required for the wire alone works out at 1.9 sq. in. To allow for the bobbin, insulation, and leads, it is suggested that about 4 or 5 sq. in. be allowed. The dimension F in Fig. 1 could thus be 1.375 in., and the dimension G could be 3.5 in.

Letters

Model Electric Motors

DEAR SIR,—I have read some of the correspondence about model electric traction, and I agree that there is a lack of published information [on] this subject. I refer particularly to the class [of] motor used in electric model railways up to, say, $1\frac{3}{4}$ in. gauge. Data about design and performance of such motors seem very scanty. I recollect seeing a letter describing some tests on motors for model locomotives where the efficiency varied from 7 per cent. to a maximum of 15 per cent.; but this did not give many constructive details. "Fill the slots and hope for the best" seems to be the general rule.

Those who wish to build their own motors are usually in the dark about armature dimensions, slots, size of wire, number of turns, etc., as nobody seems to mention these details, except in a very few cases. Again, even if a design is described in some detail, the description is of the mechanical parts chiefly, and the actual performance is left out; *i.e.*, with a given input to a given design, what did the motor *do*? Perhaps some readers do not see the use of bothering about such things with these very tiny motors? As long as they work, that is the main thing. But such an attitude won't get us very far.

A big point with these small motors is the number of slots and type of winding used. The most popular type is the "tri-polar" or 3-slot armature, gaily described as "self-starting" in catalogues. The writer regards this type as a[n] abortion, in spite of its popularity. It is [not] always self starting, and is so unbalanced electrically that a correct brush position is impossible, especially when wound with the infamous "open-circuit" or "star-point" winding, which is at once the simplest and worst of all windings except the old Siemens shuttle armature. The consequent sparking and vibration, especially on a.c., together with the miserable brush gear, soon spoil both bearings and commutator.

I have seen (and had to repair) a motor from a 2-in. gauge locomotive, in which the armature—3-pole, of course—was $1\frac{1}{4}$ in. diameter, and the commutator end "journal" was only $\frac{1}{16}$ in. diameter. This bearing soon became a slot, as it was not bushed.

The tri-polar armature simply has not enough coils to give a good performance; also, the slots are so distorted in shape that the teeth really do look like poles.

Four slots, I think, should be avoided; the winding is no better, and "tooth locking" may occur. I have heard of very small armatures of 1 in. diameter or less, with five slots, but have not seen them. Six to eight slots is more hopeful. The slots are smaller; but the more coils, or sections, the winding has the better.

It follows that, for a given winding, on an armature of given diameter, increasing the number of slots means less room for the wire, which in turn means smaller wire size and higher resistance, leading to higher voltages, especially with a.c.

20 volts a.c. is now widely used for "O"-gauge instead of the old 4-8 volts d.c. This is all to the good, and voltages might with advantage be even higher. All those who operate model electric railways know what a bugbear "contact trouble" is, a point somewhat in favour of higher voltages.

Builders of small steam locomotives know that some things won't "scale down"; *e.g.* size of a drop of oil, or the boiling point of water. On the electrical side, it is the same with "ampere turns"; quite a lot of them are needed for a motor field, or to pull in even a small contactor. A scale model of a standard railway traction motor, with nice little field poles and "scale" commutator and brush-gear would be useless for real work, as sufficient ampere turns could not be got on the field poles in the available space. This, of course, refers to wound fields.

A look at the motor of any "O"-gauge locomotive will show the out-of-scale size of the field magnet, and also that the field A/T are usually concentrated in a single coil, which construction makes the best use of the limited space available.

As one of your correspondents has pointed out, the position in the world of model electric locomotives is very similar to that obtaining in the model steam locomotive world about 25 years ago, before it was shown what could be done by careful attention to design, and by breaking away from accepted designs.

I am aware that more might be said from the manufacturer's point of view; but he has his own problems, not little ones either, and this letter is written more from the angle of the user and prospective builder of such motors.

Yours faithfully,

Cape Town. A. E. F. SPENCE.

Clubs

Staines and District Society of Model Engineers and Craftsmen

Our first Annual General Meeting was held on October 10th, at the headquarters, Phoenix Hotel, Church Street, Staines. A very interesting report of the year's progress was given by the secretary. Twenty-two general meetings were held during the year, well attended, despite small membership, which now comprises over twenty active members.

The track committee produced a specimen section of portable track, and following criticism by members, drawings were prepared and construction will commence as soon as material is forthcoming. A design for bogie trucks has also been prepared and two cars for use on track will be in production soon.

Our exhibition at Staines proved a great success; 1,200 visited the show in one day. We have also stocked up a club library, which, with the "Club Shop," has proved very popular.

Models have been exhibited by us at Ealing, and at Slough, where we obtained two first prizes, one third, and a special, to Mr. Hasling, for his "Locomotion No. 1."

Four members have affiliated to the M.P.B.A. Mr. Staines representing the Society. Many visits have been paid to other clubs, Slough, Malden, Godalming, Vickers, and the spirit of friendship was always much in evidence.

We look forward with great confidence to our second year, and shall be pleased to welcome new members, lone hands and other club members at our meetings, held every other Wednesday, at Phoenix Hotel, Staines.

Full details can be had from Hon. Secretary: R. F. SLADE, 166, Kingston Road, Staines.

Wolverhampton Model Engineering Society

The above society holds its meetings weekly, on Tuesdays, at 7.30 p.m., in the Workshop above Messrs. Wedge Bros., St. James' Square, Wolverhampton. A series of visits to local works are being arranged, the first of which is to take place on Saturday, November 23rd, 1946, at 3.0 p.m., when the Society is to visit the works of Messrs. Boulton and Paul Ltd., Wolverhampton. Applications for membership would be welcomed, and should be addressed to the Hon. Secretary: R. HOOD, 72, Canterbury Road, Penn, Wolverhampton.

Mancunian Model Engineering Society

A very interesting talk was given by our Mr. Meadows on "Pattern Making," October 25th meeting, and although pushed for time to fit his subject in, justice was done and the many questions were given a ready and satisfactory answer.

We had an interesting talk on "Foundry Practice," on November 1st, given by our Mr. Robertson, in his own inimitable way, and did the members enjoy it? Well, you come along and ask them. Something of interest each week.

The proposed model-car film show has suffered a temporary set-back, smallest sub-standard films available being 16-mm.

An attempt is to be made to secure a suitable projector on loan, and if successful, the show will go on. Meetings are held each Friday, at 8.0 p.m., Girls' Institute, Mill Street, Ancoats, (next Ancoats' Hospital). Visitors and prospective members welcome.

A bring and Buy Sale of tools, materials, etc., will take place on November 22nd, so don't forget your goods and your cash.

Hon. Secretary: J. MEADOWS, 90, Bank Street, Clayton, Manchester, 11.

The Bristol Ship Model Club

Our winter programme is as follows:—
December 10th, "Native Craft," by N. Poole.
January 14th, social evening.
February 11th, guest night (Dr. Longridge).
March 11th, annual general meeting.
April 15th, opening summer session, also
January 7th, Exhibition of models with Shiplovers' Society.

Hon. Secretary: ARTHUR W. KIRTON, 29, New Fosseway Road, Knowle, Bristol, 4.

The Society of Model and Experimental Engineers

There will be a Rummage Sale at the Workshop on Saturday, November 30th, commencing at 2.30 p.m. This will be a private sale, limited to members and affiliated members of the Society. Notice is hereby given of the Annual General Meeting to be held at 39, Victoria Street, Westminster, S.W.1, on Saturday, December 7th, at 2.30 p.m. Will all members who have the interests of the Society at heart make a special effort to attend, for it is a the A.G.M. that suggestions and criticism should be brought forward, and on this occasion there is much for discussion.

Full particulars of the Society can be obtained from the Sec.: J. J. PACEY, 69, Chandos Avenue, Whetstone, N.20.

Colchester Model Engineers Society

A society is being formed in Colchester, and it is hoped that enthusiastic support will be forthcoming. Full particulars may be obtained from the Joint Hon. Secs., D. E. KENT, 54, Maldon Road, Colchester; and P. STOWE, c/o Messrs. Woods, Braiswick Works, Colchester.

Grimsby and Cleethorpes Society of Model and Experimental Engineers

At the last meeting, our Hon. Treasurer, Mr. Geo. Robinson, gave an interesting lecture on small electric motors, including advice on conversion of commercial products to suit the needs of passenger-hauling electric locomotives, it being understood that certain members are experimenting in this direction.

Efforts are being made to locate a suitable site for a club track, and any help to this end would be appreciated.

Hon. Asst. Sec.: K. T. SMITH, 8, Malmesbury Drive, Grimsby.

Scunthorpe Society of Model Engineers

The above Society held its Annual Meeting recently. The year's events were reviewed and the "Cottingham Cup" presented to Mr. E. Peckett for the best member's model exhibited

at the recent Exhibition. Membership has increased.

The following officials were appointed: President, E. Bradshaw; Vice-President, A. V. Gregory; Chairman, F. Brocklesby; Vice-Chairman, T. Culpin; Committee—Messrs. Wilkinson, Hailstrap, Peckett and Goodyear; Hon. Secretary, DAVID P. NASH, 70, Exeter Road, Scunthorpe.

West Riding Small Locomotive Society

Our club fixtures for the next few months are: December 14th, at Blackgates (Tingley), 3.0 p.m., Annual General Meeting; March 7th and 8th, 10th to 15th, 1947, Exhibition of Models and Handicrafts at Bradford; March, 19th to 22nd, 1947, Exhibition of Models and Handicrafts at Leeds.

Hon. Sec.: W. D. HOLLINGS, 8, Limetree Grove, Birkenshaw, Bradford.

South London Model Engineering Society

The next meeting will be held on Sunday, December 1st, when Mr. A. Davidson will give a talk on "Building a $3\frac{1}{2}$-in. Gauge Locomotive." The following meeting will be on December 15th, when Mr. Watts's subject will be "Stationary Engines."

Meetings are held at King's College Sports Ground, Dog Kennel Hill, East Dulwich, and start at 11 a.m.

Hon. Sec., W. R. COOK, 103, Engleheart Road, Catford, S.E.6.

Exeter and District Model Engineers Society

The Society is expanding very rapidly and a programme to satisfy all the members has recently been drawn up.

Besides the meetings, we are very active constructing 135 yd. of multi-gauge track for locomotives of $1\frac{1}{4}$-in., $2\frac{1}{2}$-in., $3\frac{1}{2}$-in. and 3-in. gauges.

There is also a lot of talk regarding an exhibition which we hope to hold early in the New Year.

All our meetings are held in the Lecture Room of St. Luke's College, Exeter, at 7.0 p.m.

Finally, a word on our "Free and Easy Nights." These are for the members to have a chin-wag, discussing their problems, show bits and pieces, have models running, and finally to put the locomotives through their paces on the new track.

Hon. Sec., G. W. BELL, 44, Retreat Road, Topsham, Nr. Exeter.

Croydon Society of Model Engineers

The recent talk by Mr. Irwin on "Radar" was well attended and, whilst being of a simple nature in order to cater for the members who had no knowledge of radio, it was sufficiently detailed and advanced to hold the attention of even the most experienced radio fans. Mr. Irwin dealt very effectively with the many intelligent questions fired from all sides, although, of course, the evening was, as always, far too short.

A visit has been arranged for Saturday, November 23rd, to the *Evening Standard* Printing Press, which should prove very interesting.

Hon. Sec.: L. G. BOOMER, 11, Tritton Avenue, Beddington, Croydon.

Whitefield Model and Engineering Society

Mr. Priestley's lecture on the Lancashire & Yorkshire Railway was a great success at our meeting on November 1st. The episcope used was home-made and very good. Friday, November 29th, is the probable date of the first annual general meeting. Confirmation later.

Hon. Sec.: A. STEVENSON, 2, Newlands Drive, Prestwich.

Merseyside Live Steamers

Work at the track site has been continued, albeit slowly. Whether or not the track will be finished this year depends upon the weather and the extent to which members turn up at the site on Sundays. There is plenty to be done and more than the usual handful of stalwarts is needed.

A suggestion has been made that an exhibition be held in the New Year, to coincide with the official opening of the track.

Meetings will be held at the Clubroom, 32, Ennismore Road, Liverpool, at 8.0 p.m., on November 26th and December 10th.

Those seeking information regarding the club are invited to attend the meetings, or communicate with the Hon. Sec., A. E. DUCKITT, 145, Bowring Park Avenue, Liverpool, 16.

Leicester Society of Model Engineers

The next meeting will be held on Tuesday, November 26th, at 9, Wellington Street, at 7.0 p.m.

Mr. C. Meadows, of the Malden and District S.M.E., will give a lecture on "How Not to Photograph a Model."

Hon. Sec.: E. DALLASTON, 67, Skipworth Street, Highfields, Leicester.

Stockport and District Society of Model Engineers

On Friday, November 1st, we entertained Mr. Harper, the president of the Eccles Society, who gave an interesting talk about the activities of the Northern Association. Member Mr. Jones described and demonstrated his model destroyer and radio control for same.

Mr. Whister (member) will give a talk upon "Crewe Works and After" on Friday, November 29th.

All lone hands and visitors are welcome at any of these meetings held in the Dyers & Bleachers Club, Teviot Dale, Stockport, at 8.0 p.m.

Hon. Sec.: E. TERRY, 17, South Place, Bramhall, Stockport.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects, which should be addressed to him at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall and Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 23, Great Queen Street, London, W.C.2.

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Split Chucks for Watchmakers' Lathes, 6 mm., 6½ mm., and 8 mm., at 7s. each, postage 6d.—JOHN MORRIS, 64, Clerkenwell Road, London, E.C.1.

Infinitely Variable Speed Gear, ratio 16 : 1, material supplied, leaflets—CROWTHER, 85, Charlotte St., Rochdale.

"Little John" Lathes. Sole Selling Agents for Home and Export. Send for illustrated literature and orders to—THE ACORN MACHINE TOOL Co. (1936) LTD., 610/614, High Road, Chiswick, London, W.4. Telephone: CHIswick 3416-7-8-9.

Lathes Wanted, any type.—80, Ridgeview Road, London, N.20.

40 T.P.I. Ground Thread Taps, 3/16" to ½", ready shortly. Enquiries to—ESSEX ENGINEERING LTD., 50, Farnham Road, Seven Kings, Essex.

Chucks, Burnerd Precision, 4" self-centring, £5 17s. 6d.; 5", £7 19s.; Crown 4", £4; 5", £4 10s.; 6½", £5 2s. 6d.; 6" Independent, £3 18s. 6d.; Backplates screwed to suit your mandrel. Precision and General Machining done to your requirements.—CORBETTS (LATHES), Stanton Hill, Mansfield. Tel. 583, Sutton-in-Ashfield.

Wanted, H.S.S. Drills, Taps, Reamers, Dies, and other small cutting tools.—Box No. 4200, MODEL ENGINEER Offices.

Pressure Gauges, calibrated, ranges between 2 and 4,000 lb., 3s. 6d. each.—LANGLOIS, 1, Solent Court, Lee-on-Solent, Hants.

6" 4-Jaw Independent Chuck, hardened, ground, nearly new, £5.—MULLANEY, 10, Range Road, Whalley Range, Manchester, Lancs.

Wanted by Model Engineer, Lathe 2"-3½", S.C. or plain. Full particulars and price to—Box No. 4204, MODEL ENGINEER Offices.

For Sale, 1⅝" Super Adept Lathe, face-plate, driver plate, chuck, £6.—GOODWIN, 17, Eastfield Grove, Wolverhampton.

Machinery. 24" Eberhart Shaper, £120; 54" Planer, £90; Plough Grinder, cup wheel, 48" table, £155; Capitol 8" motorised Lathe, £150; Empire 6½" motorised Lathe, £195; Ward No. 7 Capstans, £145 each; Exacta ⅝" motorised, £62; Smart & Brown 2nd Operation Lathe (12), £60; Matterson No. 11 motorised Thread Mills, £55; Herbert No. 3 Capstans, covered beds, as new, £195; Denbigh 46" × 10" Universal, motorised, all enclosed Miller, £165; Denbigh plain motorised Mill, £95; Lang 8" gap bed Lathe, motorised, £85; 200 amp. Alder 15 h.p. Motor Generator Welding Plant, £90; 150 other Machines, seen any time.—VICTA ENGINEERING COMPANY, Maidenhead. Telephone 50.

Motor-driven Bench Drills, £15; Pillar Drill B.D. £6 10s.; hand-operated Bench Drill, £6 10s.; 18" Wet Grindstone, £1; Vertical Slide for 6" lathe, £8.—GEARCRAFT, Macfarlane Rd., W.12.

Brand New No. 2 Adept Shaper, mounted on cast-iron pillar stand, with large base, £14, carriage paid.—CARTER, 10, Shipperbottom Lane, Ramsbottom, Lancs.

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For Sale, the following Laboratory Instruments: Sullivan Universal Galvanometer No. 5, with electric lamp house, two way 350 meter scale, £16; Sullivan Universal Shunt (Potentiometer) Kelvin-Varley Slide Principle, 3 slides have gold and silver contacts, 10,000 ohms in 10 ohm steps, its other resistances make a total of 110,000 ohms., £18, worth £70 pre-war; Silvertown 10 ohm. resistance in 1/5 ohm. steps, silver and platinum contacts, dust-proof glass cover, £4; Cambridge Pyrometer, 3 micro-amps. per division, total 200 micro-amp., in large working box, £8; Osram Photo-electric Cells, type MG8, £4 10s.; type CMG8, 105 v., £5; type 22, £1 10s.; MODEL ENGINEERS for sale, Vol. 82 to Vol. 94, unbound; Vol. 79, Oct.-Dec., unbound, others bound; Vol. 78, partly bound. "Amateur Photographers," Vol. 91 to Vol. 96 to date. Offers. 1¼ 2-jaw Drilling Chuck, £2; complete compound Slide Rest, suit 8" lathe, £5. Any near offers accepted. Many other books and electrical gear. Send your requirements and S.A.E. to—138, Dashwood Avenue, High Wycombe, Bucks.

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